

# **UAV Company Operations**



**U.S. Marine Corps**

## USER SUGGESTION FORM

From:

To: COMMANDING GENERAL, DOCTRINE DIVISION (C 422), MARINE CORPS COMBAT DEVELOPMENT COMMAND, 2042 BROADWAY STREET SUITE 212, QUANTICO VA 22134-5021

Subj: RECOMMENDATIONS CONCERNING FMFM 3-22-1, *UAV COMPANY OPERATIONS*

1. In accordance with the Foreword to FMFM 3-22-1, which invites individuals to submit suggestions concerning this FMFM directly to the above addressee, the following unclassified recommendation is forwarded:

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## UAV Company Operations

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## Chapter 1

# UAV Fundamentals

Airborne reconnaissance, surveillance, and target acquisition (RSTA) assets provide the commander with less restricted observation of the battlespace than that afforded by ground-based assets. Aerial platforms are not as affected by line of sight (LOS) limitations, are capable of broader coverage, and can be deployed and redirected more quickly in response to changing situations. Airborne RSTA assets may be either manned or unmanned.

### 1001. Background

The threat to manned aircraft has increased significantly over the years due to rapid technological advances in conventional anti-air weaponry. The proliferation of these weapons to nations which previously did not possess a significant anti-air capability has been a factor. To reduce this threat to personnel and aircraft, the Marine Corps employs UAVs.

UAVs are a relatively new and scarce asset for MAGTF commanders. The UAV is versatile; the commander can use it for air RSTA. UAVs must be used to maximize their potential without duplicating the efforts of other assets.

### 1002. Present and Future UAV Systems

The Pioneer UAV system is now in active use as the interim ground-launched,

SR-UAV. Its employment is described in OH 2-2, *Remotely Piloted Vehicle Employment*, of April 1987.

This FMFM describes the follow-on UAV which will replace the Pioneer in 1995. The manual introduces many terms and explains how they apply in the context of UAV operations. It discusses the terminology and concepts needed to understand UAV operations. It also provides information regarding the basic procedures for employment of the ground-launched SR-UAV.

### 1003. UAV Definition

A UAV is a powered vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload. Ballistic, semi-ballistic vehicles, cruise missiles, and artillery projectiles are not considered UAVs. (Joint Pub 3-55.1)

### 1004. UAV Company

The UAV company provides the personnel and equipment to install, maintain, and operate UAV system(s) to support the MAGTF.

**a. Mission.** The mission of the UAV company is to provide UAV support to the MAGTF.

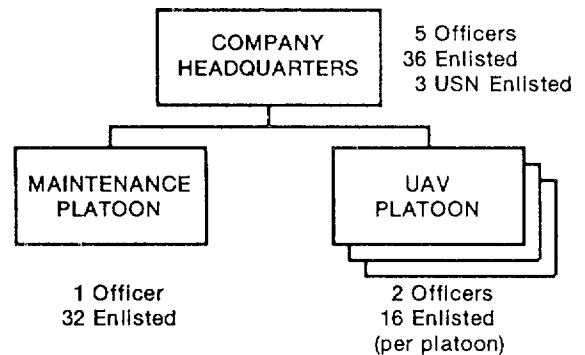
**b. Tasks.** The UAV company performs the following tasks:

- Conducts RSTA which includes performing airborne surveillance for search and rescue, and tactical recovery of aircraft and personnel; executing route and landing zone reconnaissance; and collecting damage assessment.
- Adjusts indirect fire weapons and close air support (CAS).
- Supports rear area security.
- Provides tactical radio relay, when fielded.
- Conducts individual and unit training to prepare for tactical employment and combat operations.

## 1005. Organization of the UAV Company

There is one UAV company per Marine expeditionary force (MEF). See FMFRP 1-11, *Fleet Marine Force Organization*. It is composed of a headquarters, maintenance platoon, and three flight platoons. (See fig. 1-1.) Each flight platoon has one SR-UAV system. The UAV company is not capable of independent operations. It requires external administrative and logistical support and has minimal self-defense capability. See appendix A for UAV company table of organization (T/O).

**a. Company Headquarters.** The company headquarters consists of the UAV company commander and sections for operations, intelligence, communications, support, and medical. Duties of personnel in company headquarters include advising the supported unit commander on UAV capabilities and employment, providing advice to the operations and intelligence sections of



**Figure 1-1. UAV Company Organization.**

the supported unit, and coordinating the planning and execution of UAV missions with the combat operations center (COC), the fire support coordination center (FSCC), the surveillance and reconnaissance center (SARC), and the direct air support center (DASC). The company headquarters also provides augmentation personnel to the UAV platoon during sustained operations. Administrative support for the unit is provided by the MEF or commander with administrative control (ADCON) of the UAV company.

**b. Maintenance Platoon.** The maintenance platoon consists of a maintenance officer and personnel in both ground and aviation maintenance military occupational specialties (MOSSs). The platoon provides centralized maintenance support for the UAV company. The platoon also assists with first echelon maintenance on table of equipment (T/E) items other than the UAV system. If required, some second and all higher echelon maintenance support of non-UAV T/E items may be provided by the unit to which the UAV company is administratively assigned and by combat service support (CSS) units.

**c. UAV Flight Platoon.** The UAV flight platoons operate UAV systems. Each platoon consists of mission commanders and other personnel required to execute the platoon mission. The platoon operates two watches. Each watch has a mission commander,

external UAV operator, internal pilot, payload operator, intelligence analyst, and ground control station (GCS) technician. Each UAV flight platoon is supported by intelligence analysts provided by the intelligence section of the company headquarters. GCS technicians are provided by the maintenance platoon. The mission commander ensures that the mission is flown in accordance with the mission plan and coordinates with appropriate airspace control agencies. The external operator (pilot) is responsible for launch and recovery. The internal pilot controls the UAV according to the mission plan and works with the payload operator to position the UAV to maximize payload effectiveness. The flight platoon maintains communications between each of its elements and also enters air control, fire support coordination, intelligence, and other tactical nets as dictated by the mission. Additionally, the flight platoon provides remote video terminals (RVTs) with operators to supported units, as required. Manning of the SR-UAV system requires a high degree of cross-training between operators, technicians, and analysts to include target recognition and observed fire techniques.

## 1006. Threat to UAVs

The threat to UAVs will be similar to that for a low performance aircraft. See Unmanned Aerial Vehicle Survivability Threat Assessment Reports, *Short Range Pioneer RPV System Survivability and Vulnerability*, dated 10 February 1988; Pacific Missile Test Center and Joint System Threat Assessment Report (STAR), *Close Range Unmanned Aerial Vehicle (CR-UAV) (S)*,

dated September 1990, for detailed descriptions of the threat(s).

Because the initial SR-UAV systems are designed primarily for low to mid-intensity conflict, the major threat will be from anti-aircraft artillery (AAA) and small arms used in an air defense role. This threat will increase with the improvements in tactical range, fire control/tracking radars, and reaction time that are projected for future AAA systems. Surface-to-air missiles (SAMs) may also be used against a UAV.

UAV operations will be vulnerable to enemy electronic warfare (EW). Enemy EW would be directed at the systems controlling the UAV itself and the information downlinks that are used to provide near-real-time (electronic processing delays only) combat information. Adversaries could employ both ground-based and airborne (helicopter or fixed-wing) electronic attack (EA) against operating UAV systems.

A limited threat exists from enemy aircraft. This will become more pronounced if the enemy perceives the UAV as a significant threat. Current attack helicopters possess a limited air-to-air intercept capability which could pose a significant threat to UAVs. Current fixed-wing aircraft pose a threat to UAVs, and projected improvements will increase this threat.

Directed-energy weapons such as laser, electromagnetic pulse weapons, and particle beam weapons will also pose a threat to UAV operations. This threat will be proportional to the enemy's sophistication and the success of the UAV company.

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## Chapter 2

# UAV System

The SR-UAV system found in the Marine Corps' UAV company consists of the UAVs, modular mission payloads, mission planning and control station, ground data terminals, RVTs, launch and recovery set, and ground support equipment. (See fig. 2-1.)

## 2001. Unmanned Aerial Vehicle

Each UAV system will have eight UAVs. The UAV is an unmanned flight platform.

See figure 2-2 and appendix B. The UAV and payload are remotely controlled by a GCS through a command control link or operate in a preprogrammed mode. Major systems of a UAV are—

- Airframe.
- Propulsion.
- Electrical.
- Flight Control.
- Mission Payload.
- Communications.

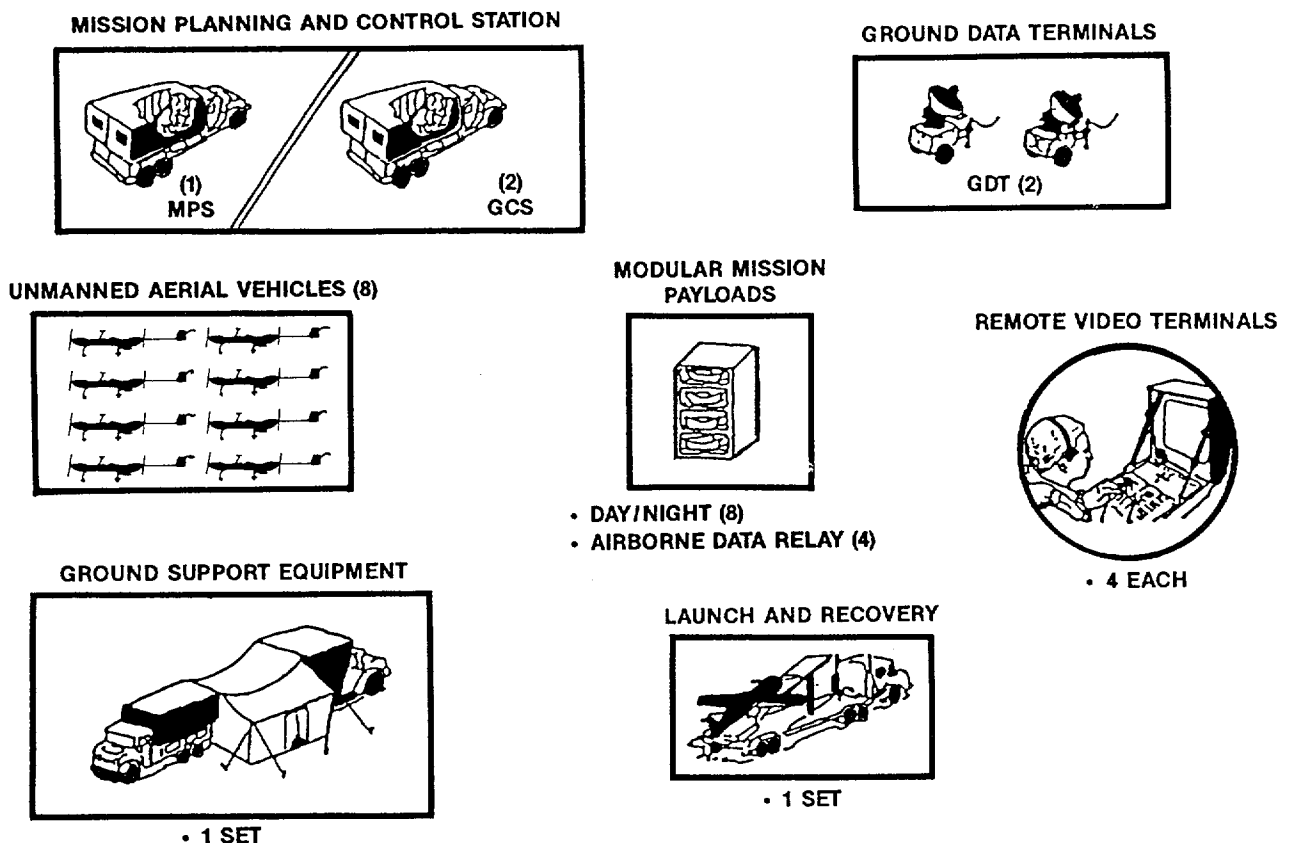


Figure 2-1. SR-UAV System.

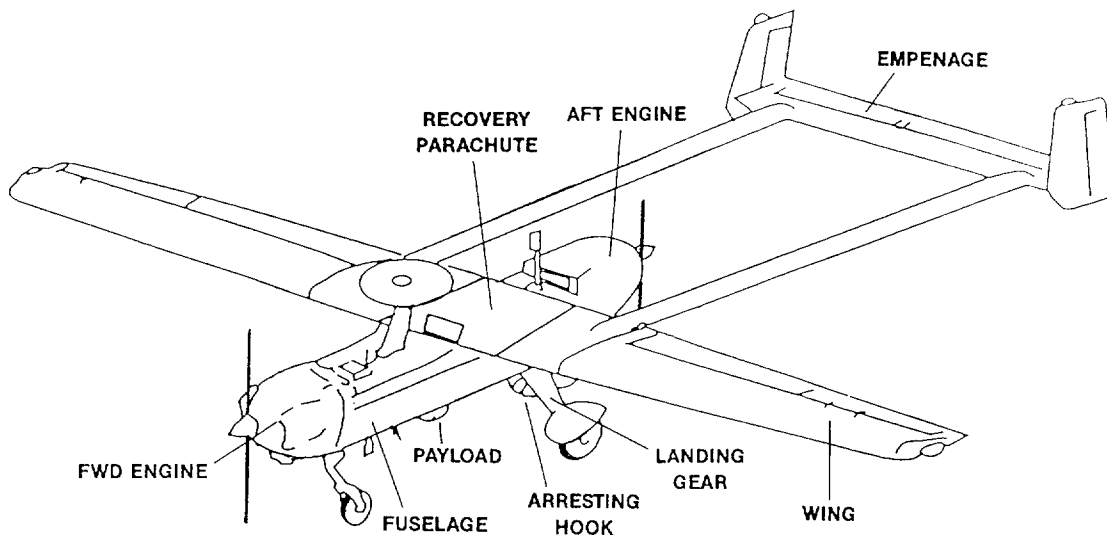


Figure 2-2. SR-UAV.

## 2002. Modular Mission Payload

The SR-UAV system will have 12 modular mission payloads (8 day/night, 4 data relay). The mission payload subsystems currently available to the SR-UAV consist of interchangeable day/night sensor (forward looking infrared (FLIR)/daylight television camera and airborne data relay (ADR). Appendix C contains information regarding mission payload specifications and characteristics.

Gimbaled sensors have a variable field-of-view, either continuous or in steps, remotely selectable from the GCS. The sensor operator may remotely track either stationary or moving targets and accurately determine locations.

The video picture produced by the camera can be transmitted near-real-time to the supported unit or taped in the GCS or UAV for later dissemination and analysis. The black-and-white video resolution is sufficient to allow for imagery interpretation

depending on the slant range distance when the video was acquired.

The ADR is used to extend the primary (penetrator) UAV range, overcome an LOS transmission problem, or effect retransmission of the penetrator payload product to RVTs.

## 2003. Mission Planning and Control Station

The mission planning and control station (MPCS) consists of one mission planning station (MPS), two GCSs, and associated antenna ground data terminal (GDT) and communications equipment. Either station can plan and execute UAV missions. (See fig. 2-3.) The MPCS, with the MPS and one GCS (each with its own GDT), serves as the operations center for the UAV mission control team. (The terms MPS/GCS are basically interchangeable except the MPS has more data storage and computing capability). The MPCS is a small, modular control station installed in a shelter. The control shelter includes the UAV and payload control bays,

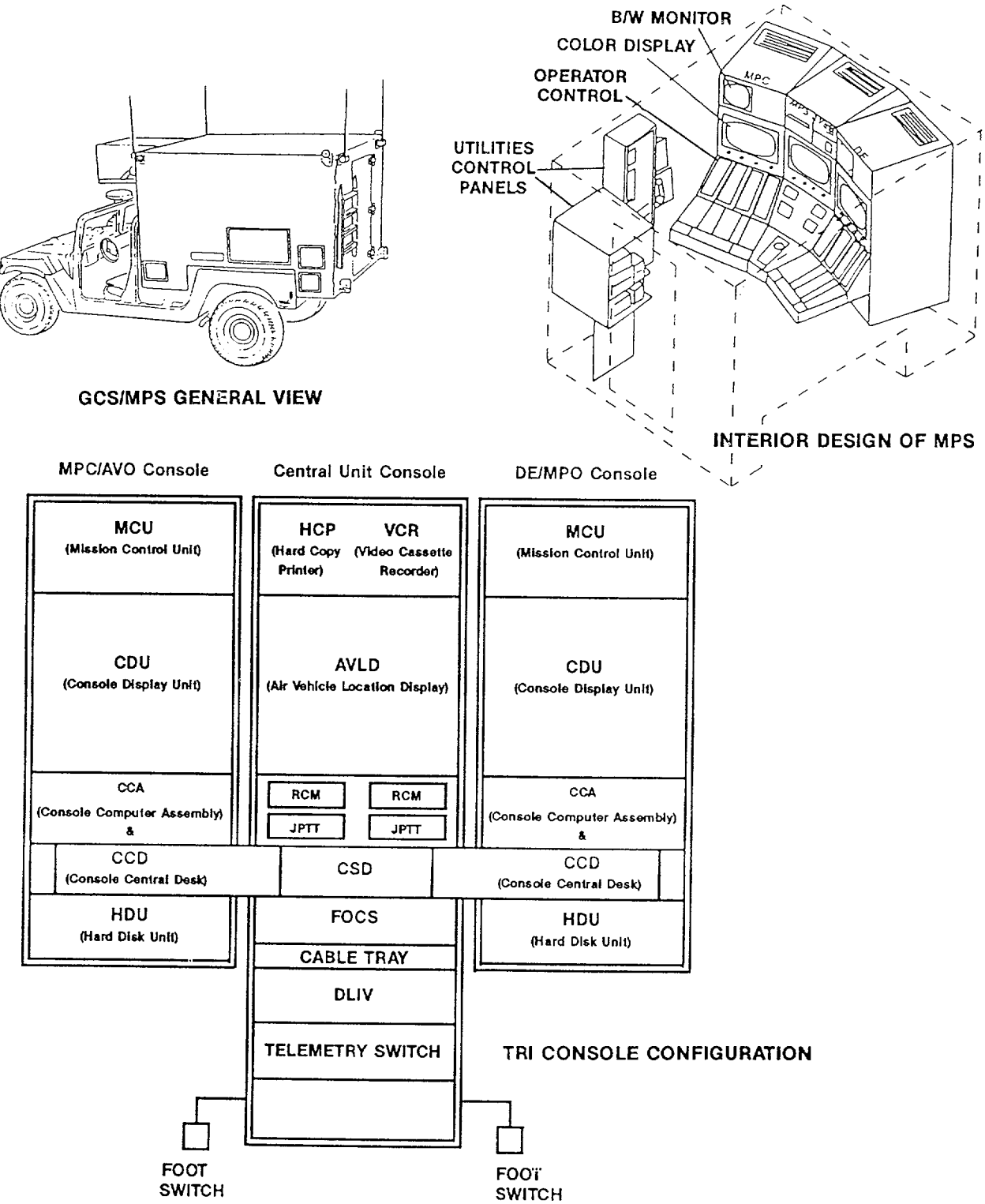


Figure 2-3. Mission Planning and Control Station.

map and terrain data, computer interfaces, nuclear, biological, and chemical (NBC) protection, and communications equipment. The shelter is mounted on a high mobility multipurpose wheeled vehicle (HMMWV), thus making the station easy to transport and quick to deploy. The main functions of the MPCS are to control and monitor the operation of the UAV(s) and the installed payload(s) and to provide initial product analytic capability to rapidly determine the relative tactical value of the product (subsequent analysis can be accomplished at the appropriate level using the mission video tapes). However, since all preflight, takeoff, landing, post flights, and maintenance procedures and functions can be performed from either the MPS or GCS, the station(s) can be used for controlling the UAV system during all mission steps.

## 2004. Ground Data Terminal

The SR-UAV system has two GDTs. The GDT (see fig. 2-4) controls all UAV tracking and communication functions, manages all up and down link data processing, and may perform preflight and system diagnostic tests. The GDT houses the radio transceiver and antenna subsystems for the ground control station and is slaved to it by remoting cables. The GDT may be remoted up to 400 meters from the GCS via fiber optic cable.

## 2005. Remote Video Terminal

The SR-UAV system has four RVTs. The RVT (see fig. 2-4) is a miniature television receiver with video recorder. It is used by commanders and their staffs for near-real-time video pictures, supplemental to the voice reports received from the MPCS. Directional antennas provided with each RVT allow for video reception up to approximately 40 kilometers from the selected UAV. The RVT is small enough to be carried in light vehicles or trailers.

## 2006. Launch and Recovery Set

The launch and recovery set includes a launch and recovery station (LRS) and its associated antenna and communications equipment and a UAV launcher or rocket assisted takeoff (RATO) stand, if required. The LRS is a reduced version of the GCS or MPS with GDT with a corresponding reduction in capability. It allows UAV launch and recovery from a remote site, afloat or ashore, distant from an MPCS. The UAV operator within the LRS can perform takeoff and initial flight control until command of the UAV is transferred to an internal pilot in an MPS or GCS. The LRS is mounted on a HMMWV and contains the following three subsystems: flight control, communications, and power supply. The following launch and recovery methods can be used.

**a. Launch.** There are two possible methods of launching the SR-UAV. First, an aircraft-style runway takeoff can be used. A fully fueled UAV with a payload uses about 300 meters of hard surface runway/road to become airborne. Second, a RATO unit may be attached to the air vehicle. The UAV is placed on a launch stand, the rocket boost unit accelerates the UAV to flight speed, and the rocket system is ejected from the UAV and recovered. (See fig. 2-4.)

**b. Recovery.** During routine operations, the UAV can be recovered using an arresting cable system. Two arresting cables, spaced approximately 50 feet apart, are stretched across the runway; each cable is anchored in two energy-absorbing drums positioned on either side of the runway. Upon touchdown, the tailhook of the UAV engages an arresting cable which then decelerates the UAV. The recovery area for normal operations is 70 meters. An arrested recovery using shorter distance than normal is extremely hard on the UAV and should be avoided when possible. To recover the UAV in a

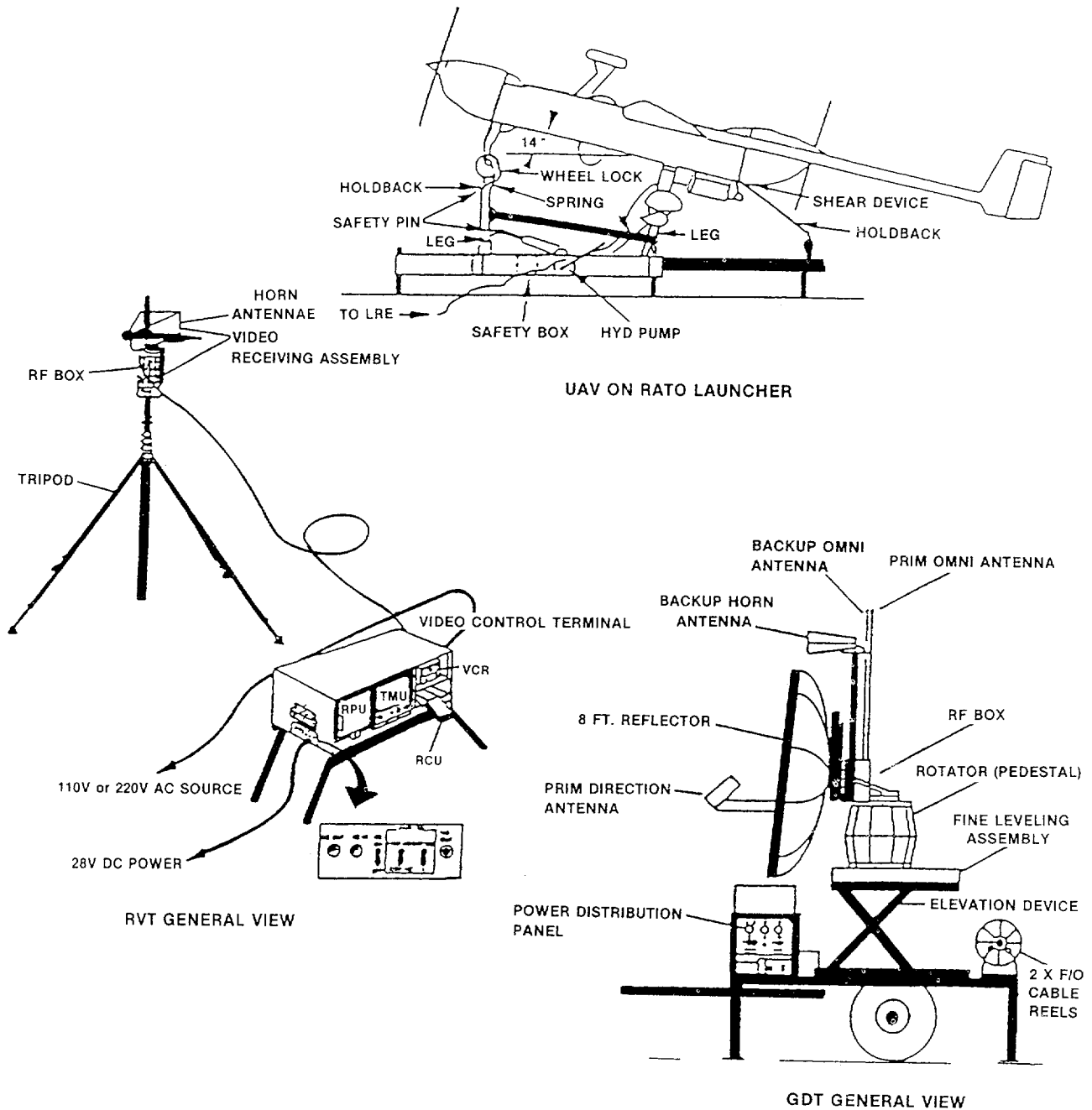


Figure 2-4. RATO Launcher, RVT, and the GDT.

Collocating the GCS with the supported unit provides the most responsive UAV support. When this is not possible, establishment of a communications link is required. When possible, liaison to include RVT should be provided.

## 3002. Advantages

A real-time data link capability which provides video for acquisition, storage, interpretation, and dissemination of combat information. There are two means of data storage:

- Digital cassette recorder—uses 45-minute cassette; records uplink control and downlink telemetry, intercommunications system, and timing signals.
- Video cassette recorders—use 2-hour, super 8mm tape; records video transmissions from the UAV. These are found in the control station(s), the RVTs, and on board the UAV itself for automatic recording during autonomous missions.

A lower probability of detection due to the reduced signatures of the UAV (infrared [IR], radar, acoustic, visual) versus manned aircraft.

Rapid and accurate targeting for adjustment of supporting arms.

A day/night operational capability.

A programmed (autonomous) mode of operation that reduces radio frequency (RF) emissions.

Reduced exposure of manned aircraft to enemy air defense systems.

No requirement to collocate GCS(s) and launch/recovery equipment.

The ability to place RVTs throughout the theater of operations and receive the collected UAV *data* while the mission progresses vice waiting for mission analysis and dissemination.

## 3003. Disadvantages

The SR-UAV system is based on a flying machine and operations are degraded or denied in severe weather conditions. These include—

- Operations below 25 degrees fahrenheit (°F) or above 120°F.
- Operations for more than one hour in rain shower of 2 inches per hour in winds up to 35 knots (kts).
- Snow or moderate ice accumulations on the UAV during daylight.
- Launch and recovery (L/R) of the UAV in winds exceeding 35 kts steady, 45 kts gusts, or a cross wind component of 20 kts.
- Ground component equipment operation in winds above 65 kts.

Payload video quality is reduced by certain meteorological conditions and battlefield obscurants.

UAV flight performance is degraded at higher altitudes.

An LOS transmission limitation during manually controlled flight between the UAV and the GDT or RVT.

While more than one UAV may be airborne at any given time, the payload sensor data can only be processed by a GDT from one UAV at a time.

Transportation requirements include handling of non-milspec equipment.

System location data accuracy is determined by global positioning system (GPS).

Special fuel storage considerations for UAV fuel are required.

### 3004. Vulnerabilities

The present video signal is omnidirectional when broadcasting to RVTs. It is also non-encrypted; therefore, the signal can be interrupted or exploited by threat forces with compatible equipment.

The SR-UAV is not hardened and, due to its visual signature, is susceptible to destruction by AAA or other surface-to-air weapons (SAWs).

When UAV operations require that the GCS be an emitter (nonautonomous flight), the signal is susceptible to enemy EW actions. See FMFM 7-12, *Electronic Warfare*, and FMFRP 15-5, *Electronic Warfare in Combined Arms*.

### 3005. Employment of the UAV Company

UAVs can be used for many purposes and by many types of units. The UAV can conduct reconnaissance for infantry battalions and surveillance for the division or MEF commander. UAVs can perform target acquisition and fire adjustment for artillery, naval surface fire support (NSFS), and CAS. See FMFM 2-7, *Fire Support in MAGTF Operations*; FMFM 6-18, *Techniques and Procedures for Fire Support Coordination*; and FMFM 5-41, *Close Air Support and Close-in Fire Support*. The UAV can support an offensive antiair warfare (OAAW) strike by locating enemy SAM systems, forcing them to radiate or launch weapons. The SAM systems are thus targeted for electronic or physical attack. See FMFM 5-45, *Suppression of Enemy Air Defenses*, and FMFM 5-50, *Antiair Warfare*. UAVs can similarly

support deep air strikes. See FMFM 5-40, *Offensive Air Support*, and FMFM 5-42, *Deep Air Support*. Because each situation is unique, there is no single *correct* method of employing UAVs. The commander must decide how best the UAV company can be employed to best support his mission. He imparts this to the UAV company commander through mission assignment and commander's intent. See figures 3-1 and 3-2 for examples of SR-UAV system employment setup.

The following scenario, in which a MEF defends against an advancing enemy, illustrates some of the missions that UAVs can be assigned—

Initially, the enemy's main body is distant. The MEF commander has many types of collection assets available to collect information on the enemy and terrain. The efforts of these various assets are coordinated and integrated in the collection plan. The MEF commander can maximize employment of the UAV by using it to collect information on the distant enemy's main body and to determine the actions of the enemy's reconnaissance and advance guard elements. The UAV can also be used to observe the terrain over which the enemy must pass as he advances. The MEF commander may task the UAV unit to fly a collection mission over deep targets, locating them for deep strike missions by the aviation combat element (ACE). The information then is relayed to the MEF COC for analysis and exploitation.

As the enemy's main body advances towards the MEF, the UAV's mission is shifted to adjusting deep air support (DAS) missions on the advancing enemy and providing immediate bomb damage assessment (BDA) to the ACE and the MEF. UAV information is relayed from the GCS to the DAS aircraft, DASC, and the MEF.

locations throughout the operational theater to support different elements (Division COC, FSCC, SARC, etc.). It is imperative that the operation plans define the exact command relationships between the control station(s); and (1) who commands the station operators (who can assign or divert UAV missions); and (2) the order of mission priority (who gets the UAVs first).

**(2) Subsequent Operations (Operations Ashore).** The UAV unit is best phased ashore in on-call serials of the assault echelon. The SR-UAV is under the operational control (OPCON) of the MAGTF commander who assigns general and direct support missions to the UAV company. OPCON of the UAVs may be delegated to the headquarters with coordination responsibility for fire and direct air support of the maneuvering forces. The UAV company commander or his representative collocates with the supported headquarters as a special staff officer and advises the commander and his staff on the best employment of the SR-UAV.

Due to UAV range constraints, the GCS should be located to provide decentralized execution of UAV missions and continuous communications and coordination with the FSCC and the DASC while the UAV is airborne. Some situations may preclude locating the GCS with the coordinating headquarters, FSCC, and DASC; however, a UAV liaison team with positive communications to the controlling GCS should be located with the supported headquarters to facilitate planning and coordination. The 30-40 kilometer control range of the LRS allows UAVs to be launched, recovered, and maintained in secure areas outside the range of most artillery weapons and separate from the GCS location.

#### **b. Employment Prerequisites.**

Employment prerequisites include, but are not limited to, availability of trained SR-UAV personnel, appropriate staff personnel, prepared operational site(s), fuel, and transportation.

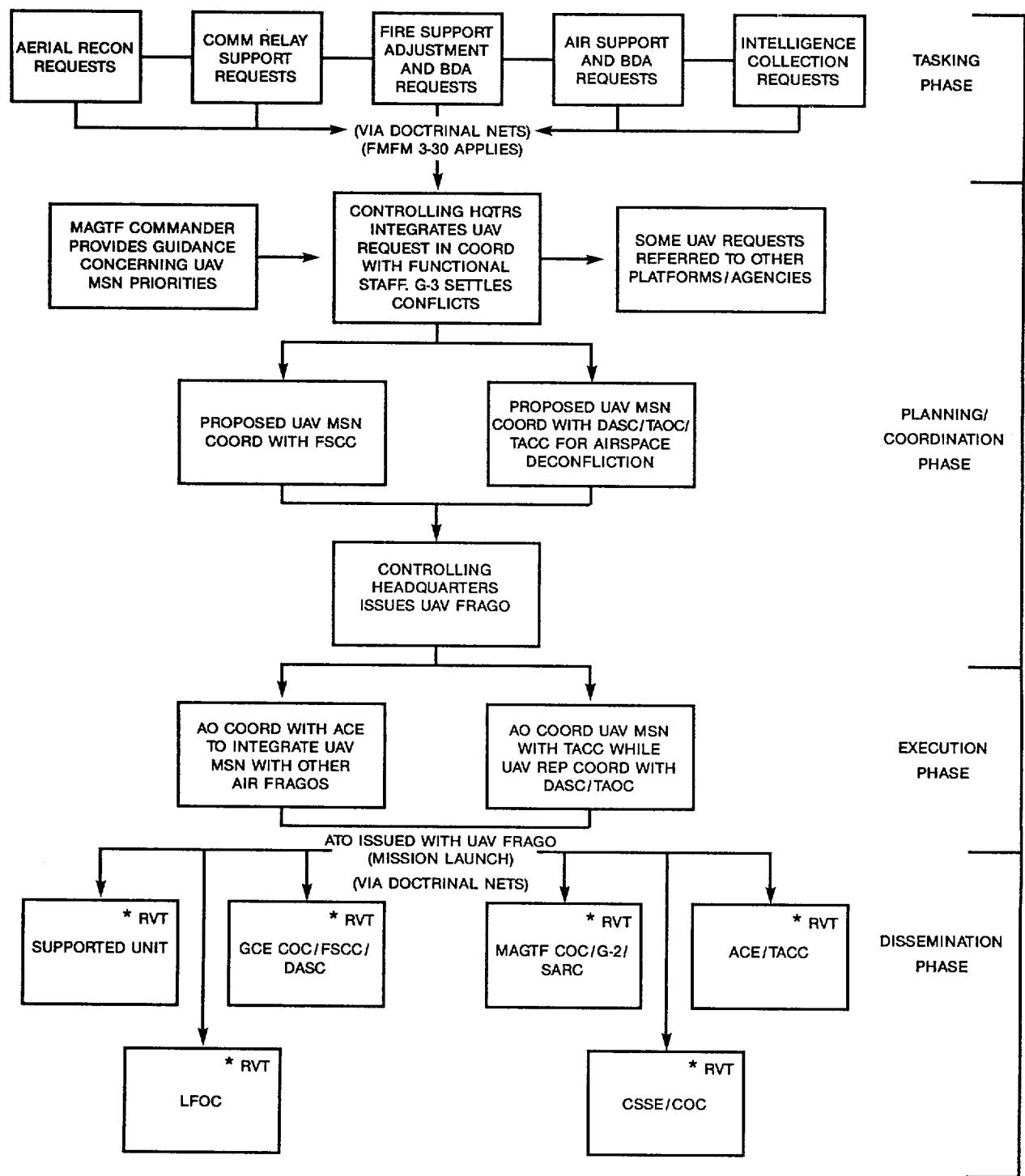
### **3006. Tasking**

The UAV company/detachment is under OPCON of the MAGTF commander who assigns support missions. OPCON of the UAVs may be delegated by the MAGTF commander per doctrinal command and control relationships. Requests for UAV missions are submitted to the supported headquarters using the joint tactical air strike request (JTAR) or the joint tactical air reconnaissance/ surveillance (JTAR/S) request form. Both preplanned and immediate UAV requests are submitted to the controlling headquarters identifying targets, locations, times, and coordinating instructions in as much detail as possible.

**a. Preplanned.** Preplanned UAV missions are initiated when the headquarters of the OPCON commander receives requests for UAV support. These are received via the JTAR/S or JTAR request forms. See appendixes D and E. The UAV company commander or liaison officer(s), acting as a special staff officer for the supported headquarters, consolidates these requests in close coordination with the air officer, G-2, G-3, fire support coordinator, and other staff officers. He then drafts a daily fragmentary order (FRAGO) based on guidance and priorities established by the MAGTF commander. Conflicting priorities over UAV missions are resolved by the MAGTF G-3, when the UAV company is in general support, and by the G-3/S-3 of the supported unit when operating in direct support. Once approved, the FRAGO, with a tentative UAV schedule attached, is coordinated with the ACE for airspace coordination and inclusion in the air tasking order (ATO). (See fig. 3-3.)

**b. Immediate.** Immediate UAV missions are missions which were not previously anticipated or arise due to rapidly changing situations. Requests for immediate UAV support are submitted via the fastest means





\* POSSIBLE LOCATION OF REMOTE VIDEO TERMINALS BASED ON MAGTF/SUPPORTED UNIT PRIORITIES.

Figure 3-3. Preplanned Mission Flow.

to the supported headquarter's COC or FSCC. The urgency of immediate UAV requests must be balanced against the loss or postponement of the preplanned UAV missions. The MAGTF commander (normally through his G-3) resolves conflicts.

Immediate missions can be executed in two ways. First, a dedicated UAV that is currently performing a mission can be diverted by higher authority to a higher priority mission. Second, the MAGTF commander can order a *standby* UAV be ready with a rudimentary mission plan already loaded. When called for, this UAV is launched and the designated control station refines the mission plan while the UAV is outbound to the objective area.

**NOTE:** If an immediate mission requirement arises while the UAV launch site is *cold* or not in a preflight/standby status, approximately two hours will be needed to prepare for launch.

## 3007. Conduct of the UAV Mission

**a. Order.** Upon receipt of the ATO, the UAV unit is provided specific tasking for UAV mission(s). With this tasking, UAV mission plans are developed.

**b. Mission Planning.** Mission planning is conducted by the UAV unit headquarters and mission flight crew at the LRS, GCS, or MPS. Mission planning must integrate many factors so that a flight route can be selected that maximizes the expected value of the flight. The MAGTF commander's priorities, established command relationships, and the various commander(s) guidance influence mission planning. Available meteorological data and SR-UAV system capabilities must be considered. Intelligence concerning known or suspected enemy locations and the threat to the UAV must be considered in planning. To allow UAV movement through

the airspace, dissemination of UAV data, and mission direction or modification, planning must include airspace control and management and communications.

### (1) Airspace Control and Management.

Mission planning must resolve airspace control and management conflicts. Airspace control and management ensures the coordination, integration, and regulation of the use of airspace of defined dimensions. The established principles of airspace control and management used in manned flight operations apply to UAV operations. See FMFM 5-60 and Joint Pub 3-52, *Doctrine for Joint Airspace Control in a Combat Zone* and Joint Pub 3-55.1, *Joint Tactics, Techniques, and Procedures for Unmanned Aerial Vehicles*. See paragraph 4003 for specific details on UAV airspace control measures. The UAV company coordinates airspace control and management through the air officer located in the senior FSCC and the DASC. This procedure facilitates the resolution of both fire and air support conflicts, as the FSCC and the DASC are generally collocated. When planning is completed, a mission plan is prepared showing the flight path and altitude. This information is provided to the appropriate agencies (normally the COC/FSCC and the DASC). When requirements dictate use of UAVs beyond that airspace coordinated by the DASC, airspace coordination responsibility normally passes from the DASC to the tactical air operations center (TAOC).

**(2) Communications.** To the greatest extent possible, existing communication nets are utilized between the UAV company with supported units and airspace control agencies. FMFM 3-30, *Communications*, provides a description of FMF radio nets. The unit is required to maintain radio communication with the controlling headquarters/supported unit and airspace control agency throughout flight operations. Additional working nets can be maintained with supported units, as appropriate.

**c. Mission Execution.** Mission execution is controlled by the mission commander. The mission commander is that designated individual of the UAV mission flight crew responsible for execution of a specific UAV mission. Changes to the approved mission (diverts) are effected per the established command authority and via the appropriate control agencies.

**(1) Prelaunch.** Prior to launch, the mission commander ensures that crew checks, mission planning, and crew briefs are completed and necessary communications are established.

**(2) Launch.** The mission commander ensures that the UAV adheres to the mission plan and coordinates any change with the DASC. The external pilot launches the UAV and conducts system flight checks, then flies the UAV to a predetermined altitude and passes control to the L/R operator. The L/R operator then flies the UAV to a predetermined GCS handover point and passes UAV control to the GCS. This procedure is optional. Control may be passed directly from the external pilot to the GCS. The UAV may climb over the LRS or enroute, if approved by the DASC. When the UAV reaches operational altitude, normally 3,000 feet to 5,000 feet above ground level (AGL), the mission commander checks with the DASC prior to the commencement of the flight plan.

**(3) Execution.** Using one or more of the UAV flight control modes, the GCS internal pilot flies the UAV mission. The payload operator concurrently executes his part of the mission, with guidance from the mission commander. The mission commander ensures that pertinent information obtained by the UAV is passed to the supported unit, and as required, to higher headquarters during the mission. The GCS keeps the supported unit and higher headquarters informed of UAV time on station. If, during the mission, an immediate tasking is received, the mission

commander coordinates changes in UAV position and altitude with the DASC. On completion of the mission, the GCS mission commander notifies the DASC of UAV return to base (RTB), and the internal pilot flies the UAV to the LRS hand-over-point. Additional feedback to the supported unit and higher headquarters is provided upon mission completion. Two types of control can be exercised over a UAV.

**(a) Manual Control.** Prior to takeoff, L/R personnel prepare the UAV and sensor payload to include system check-outs. The mission commander ensures that mission planning is complete and necessary communications are established. Airspace control and management agencies have mission planning information including route of flight, altitude, and estimated arrival times. The mission commander ensures that the UAV adheres to the planned mission and notifies the FSCC and DASC of requested changes.

Normally, the UAV remains under ground control. However, it may be placed in the preprogrammed mode to maintain a desired flight profile such as an orbit in a selected area. After launch, the UAV climbs to a predetermined altitude under the control of the autopilot or at the command of the GCS controller. For multi-UAV operations, one UAV may be put in the preprogrammed mode to fly a specified course or to circle a designated target area, while an additional UAV is launched and manually controlled. UAV positions are maintained within the GCS and, when necessary, reported to airspace control agencies. Upon conclusion of the mission, the UAV returns via designated control points to the recovery area.

**(b) Preprogrammed Control.** Preprogrammed (autonomous) control of the UAV is desirable or necessary in some situations. The preprogrammed mode

allows the UAV to proceed on a pre-selected course and perform specified patterns during loiter.

For the communication/data relay mission (using the ADR payload), the UAV is launched, flown to a selected point, and placed in a preprogrammed pattern until recovery.

The UAV is monitored by the GCS to ensure it maintains the programmed altitude and position.

**NOTE:** Any SR-UAV mission may include both control types. For multi-UAV operations, one UAV may be put in the preprogrammed mode to fly a specified course or to circle a designated target area, while an additional UAV is launched and manually (actively) controlled.

**(4) Recovery.** After handover, the L/R operator flies the UAV to the recovery site

and, when given permission to land, commences descent. During descent, UAV control is passed to the external pilot who lands the UAV. Once the UAV has landed, controlling agencies are informed. The L/R crew begins post-flight maintenance.

**(5) Return-Home Procedures.** Each flight includes planning for a remote recovery checkpoint (return-home point). If LOS between the control station and UAV is lost during the phase of the flight, the UAV automatically goes into its return-home mode. The UAV flies at a predetermined altitude and airspeed back to GCS, L/R, or a predetermined holding area. Airspace planning and coordination include provisions for the separation of manned aircraft and the UAV in the event of return-home mode activation. Upon reacquiring UAV control, the mission is continued, cancelled, or changed, as required. If control of the UAV is not reestablished, the UAV remains in an orbit at the return-home point until it runs out of fuel.

## Chapter 4

# Command and Control

UAVs can be employed in reconnaissance, surveillance, and target acquisition roles, supporting a wide variety of units, elements, or agencies. They can be used by the G-2 to gather information for intelligence requirements. They can be used as landing zone/flight route reconnaissance preceding a battalion-sized helicopterborne assault. The vast range of possible missions and supported units involved in UAV operations requires integration and coordination of planning and execution and airspace use. It requires an understanding of who is in charge. It also requires a means to assign missions and task UAVs, as well as to exercise authority over UAV operations. Command, control, and communications provide the glue that make UAV operations successful. See FMFM 3, *Command and Control*.

### 4001. Command

The UAV company is commanded by the UAV company commander, whose authority and responsibilities are similar to those of other commanders. His administrative chain runs from the commander with ADCON over the UAV company. The operational chain of command runs from the MEF commander, who tasks the company and assigns it its mission. Although the UAV is considered an aircraft, the ACE commander is not in the UAV company commander's chain of command.

### 4002. Control

**a. Types of Control.** Control is the means through which the commander extends his authority. There are five types of control, all of which apply to the UAV company.

**(1) Administrative Control.** ADCON is exercised via the administrative chain of command. The commander with ADCON over the UAV company has the authority to train, equip, and ensure the required order, discipline, maintenance, and care of the company.

**(2) Operational Control.** OPCON is exercised via the operational chain of command and rests with the MAGTF commander who employs the company to perform its combat mission.

**(3) Tactical Control (TACON).** TACON is essential to direct local maneuver and employment of the UAV. TACON is a shared responsibility between the UAV commander, whose internal and external pilots fly the UAV, and air control agencies who control the movement of the UAV through the assigned airspace. Forms of TACON, specific to aviation, are discussed in paragraph 4003.

**(4) Coordination.** Coordination is conducted by the UAV company commander with both supported and supporting organizations across the range of UAV operations.

**(5) Technical Direction.** Technical direction is exercised by the UAV company commander, who is responsible for technical operation of the SR-UAV system. This direction includes establishing standards and procedures, conducting technical training, and ensuring operational readiness.

**b. Command and Support Relationships.** The MAGTF commander exercises OPCON by establishing both command and support relationships based on informational

requirements within the force. Command relationships define how the force is to be organized. Support relationships define who is to be supported and who is to provide that support. Support relationships are established by the commander to weight his main effort by prioritizing support within the force.

The assignment of a particular mission may require task organization that modifies existing command and support relationships. Unlike command relationships, support relationships specify only the priority of effort of the supporting unit. They do not transfer responsibility for or control beyond the authority to specify priority of tasks to the supported commander.

**(1) Command Relationships.** Command relationships relative to the UAV company specify the degree of authority a senior commander has over the UAV commander. Command relationships may be either permanent or temporary. Permanent UAV command relationships follow the administrative and operational chain of command, retaining the UAV as a MEF asset under the

OPCON of the MEF commander. Temporary command relationships, such as attachment of the company or provision of detachments to MAGTFs smaller than a MEF, are possible but planners must consider unique UAV supply and maintenance support requirements.

**(2) Support Relationships.** Support relationships are mission assignments in which one commander supports another, normally at the direction or with the approval of the next higher mutual commander. Although there are instances in which the UAV company commander can be the supported commander (i.e., a ground unit might provide security to a UAV operating site), the UAV company is discussed solely in a supporting role in this chapter.

A parent command directs its units in support relationships. These relationships are used to specify a degree or priority of support. Supported commanders do not exercise command over the supporting unit, nor do they assign missions to the supporting unit. In the case of the UAV company, however, supported unit requirements makeup the

RESPONSIBILITIES								
ESTABLISH LIAISON	ESTABLISH COMM (AS APPROPRIATE)	GCS, LRS, & SUPPORT SYSTEM LOCATED BY	RVT(s) LOCATED BY	MISSION PRIORITIES ESTABLISHED BY	RESOLVES CONFLICTS	MISSIONS SCHEDULED BY	DIVERT AUTHORITY	ADMINISTRATIVE LOGISTIC SUPPORT RESPONSIBILITY
DIRECT SUPPORT								
UAV CO/DET CMDR WITH SUPPORTED UNIT	SACC/TACC JIC/LFOC (AFLOAT)	UAV CO/DET CMDR OR AS COORDINATED WITH SUPPORTED CMDR	SUPPORTED CMDR	SUPPORTED CMDR	SUPPORTED CMDR WITHIN HIS AREA OF OPERATIONS OR MAGTF CMDR	SUPPORTED CMDR	SUPPORTED CMDR	SUPPORTED UNIT OR CMDR WITH ADCON
LIAISON TEAM WITH FSCC/DASC	FSCC/DASC (ASHORE)							
GENERAL SUPPORT								
UAV CO/DET CMDR WITH MAGTF HQ	SACC/TACC JIC/LFOC (AFLOAT)	UAV CO/DET CMDR OR AS COORDINATED WITH SUPPORTED UNIT CMDR	MAGTF CMDR	MAGTF CMDR	MAGTF CMDR (NORMALLY THRU G-3)	MAGTF CMDR (NORMALLY THRU G-2/ G-3)	MAGTF CMDR OR AS APPROPRIATE	CMDR WITH ADCON
LIAISON TEAM WITH FSCC/DASC	FSCC/DASC (ASHORE)							

Figure 4-1. General and Direct Support Responsibilities.

basis for UAV operations. Generally, the UAV company, or elements of the company, are employed in either general support or direct support. Responsibilities under general support and direct support are shown in figure 4-1.

**(a) General Support (GS).** When the UAV company or a detachment from the company operates in GS, it supports the entire MAGTF. Requirements for UAV support may be on behalf of the entire MAGTF or in response to specific subordinate elements. The MAGTF commander determines priority of support and resolves any conflicts. Under GS, priority of support to subordinate elements will likely go to the unit that is the main effort.

**(b) Direct Support (DS).** When the UAV company operates in DS, it responds to a specific, designated unit, providing UAV support with the supported unit's specific stated requirements. Priority of support goes to the supported unit but other missions may be performed provided they do not interfere with completion of the supported unit requirements. Under DS, the UAV company or detachment should provide liaison to, and communications with, the supported unit in order to forward requirements, disseminate reporting, and conduct coordination.

**(3) Factors Influencing Support Relationships.** No single mode of support for UAV employment is appropriate to all situations. The MAGTF commander adopts a particular mode of support for a given situation based on his assessment of the situation and his vision of how the mission will be accomplished. His allocation of UAV support reflects a balanced decision on how to best exploit UAV intelligence collection, fire support adjustment, and maneuver control capabilities. UAV assets are finite and must be applied where they are most needed and will have the greatest effect. Generally, the major subordinate element that is the main

effort should receive the highest priority for support.

**(a) MAGTF Requirements.** The MAGTF commander's concepts for both future and deep operations depend largely on his vision of what the enemy will do and how the weather and terrain will affect operations. If a commander has adequate information on terrain, weather, and the enemy and friendly forces, he will accurately foresee the general course of coming events. The commander's view of enemy capabilities and intentions is obscured by the fog of war in general and, specifically, by enemy command and control warfare (C<sup>2</sup>W) actions. Accordingly, the MAGTF commander's most common use of UAVs, pursuant to his own requirements, will be for intelligence tasking and in support of deep operations (in GS).

**(b) General Support.** GS better enables the MAGTF commander to provide UAV capabilities to the force as a whole, as well as to respond to requirements of higher and adjacent headquarters, but at the expense of timely response to subordinate element's requirements. GS also provides the MAGTF commander with the capability to hold assets back in order to exploit unexpected opportunities or respond to unexpected problems or contingencies. GS can potentially restrict the MAGTF commander from shifting the focus of UAV support within the MAGTF in response to short notice requirements. When the MAGTF commander employs the UAV company in GS, it is critical that he ensure that MAGTF elements without control authority over UAV assets have the best possible access to UAV support.

**(c) Direct Support.** In the conduct of current operations, the GCE commander who conducts current operations confronts a rapidly changing environment. In this environment, UAV support,

centralized at the MAGTF headquarters, may not respond quickly enough to exploit fleeting opportunities or satisfy rapidly occurring requirements. UAVs providing DS afford best and most timely response to the major subordinate element commander to whom control has been delegated. Under DS, the supported commander can specify the time and place for intelligence collection missions and is able to receive near-real-time information during missions. The supported commander also has greater flexibility in the selection of targets upon which UAVs assist in adjusting supporting arms.

### 4003. Forms of Control Specific to Aviation

Because UAVs are considered aircraft, several other forms of control, specific to aviation, apply to their employment. The most common of these are air control, airspace control, and air direction. These forms of control are exercised by the personnel and agencies of air command and control systems as follows:

- **Amphibious Tactical Air Control System (ATACS).** ATACS provides a single coordinated air control system to control and coordinate all air operations within the amphibious objective area (AOA). The CATF is responsible for the organization and employment of the entire ATACS. The ATACS is comprised of the Navy tactical air control system (NTACS) and the MACCS.
- **Marine Air Command and Control System (MACCS).** The MACCS is designed to provide the CLF (MAGTF commander) with the capabilities to command, control, coordinate, and manage the ACE supporting the landing force (MAGTF). Similar to the NTACS, MACCS provides for

centralized command, coordination, and supervision of air operations at the highest level while incorporating decentralized control to subordinate agencies. The MACCS is task organized to provide personnel and equipment for the exercise of authority over, and direction of, all air operations. The MACCS is tasked with the control and coordination of offensive air support, assault support, air reconnaissance, antiair warfare (AAW), and EW functions of Marine aviation in support of the MAGTF. The MACCS is also responsible for the control and coordination of the MAGTF's integrated air defense system (IADS) within the MAGTF's operational boundaries.

**a. Air Control.** Air control is the authority to direct the physical maneuver of a UAV in flight or direct a UAV to image a specific target. FMFM 5-60 defines control of aircraft and missiles as "the coordinated employment of facilities, equipment, communications, procedures, and personnel which allows the ACE commander to plan, direct, and control the efforts of the ACE to support the accomplishment of the MAGTF's mission." Although the UAV is not an ACE asset, it is controlled, when airborne, by control agencies of the ACE. In some instances, however, air control of UAVs may be exercised by air controllers that are not organic to the ACE (i.e., forward air controllers).

**b. Airspace Control.** Airspace control is a form of air control. Airspace control provides for the coordination, integration, and regulation of the use of a defined airspace. It also provides for identification of all airspace users. Any airborne object which may interfere with the flight path or trajectory of any other object within the MAGTF's airspace is of concern and has some influence on the control of aircraft and missiles. Aircraft, to include UAVs, friendly supporting arms fire, and SAWs are airspace



users. Their employment requires coordination and integration of airspace.

Airspace control is the authority to direct the maneuver of a UAV (along with other aircraft and airspace users) so the best use is made of the airspace. Airspace control is accomplished through established procedures for coordination of air, artillery, naval surface fire support, and UAV plans by appropriate elements of the MAGTF. The

principles and procedures of airspace control used in manned flight operations apply to UAV operations. UAVs are normally routed through existing air control points by airspace control agencies. (See fig. 4-2.) Airspace control authority is inherent in the commander whose unit is responsible for particular blocks of airspace, types of missions, or types of aircraft. It does not include measures to approve, disapprove, deny, or delay UAV operations.

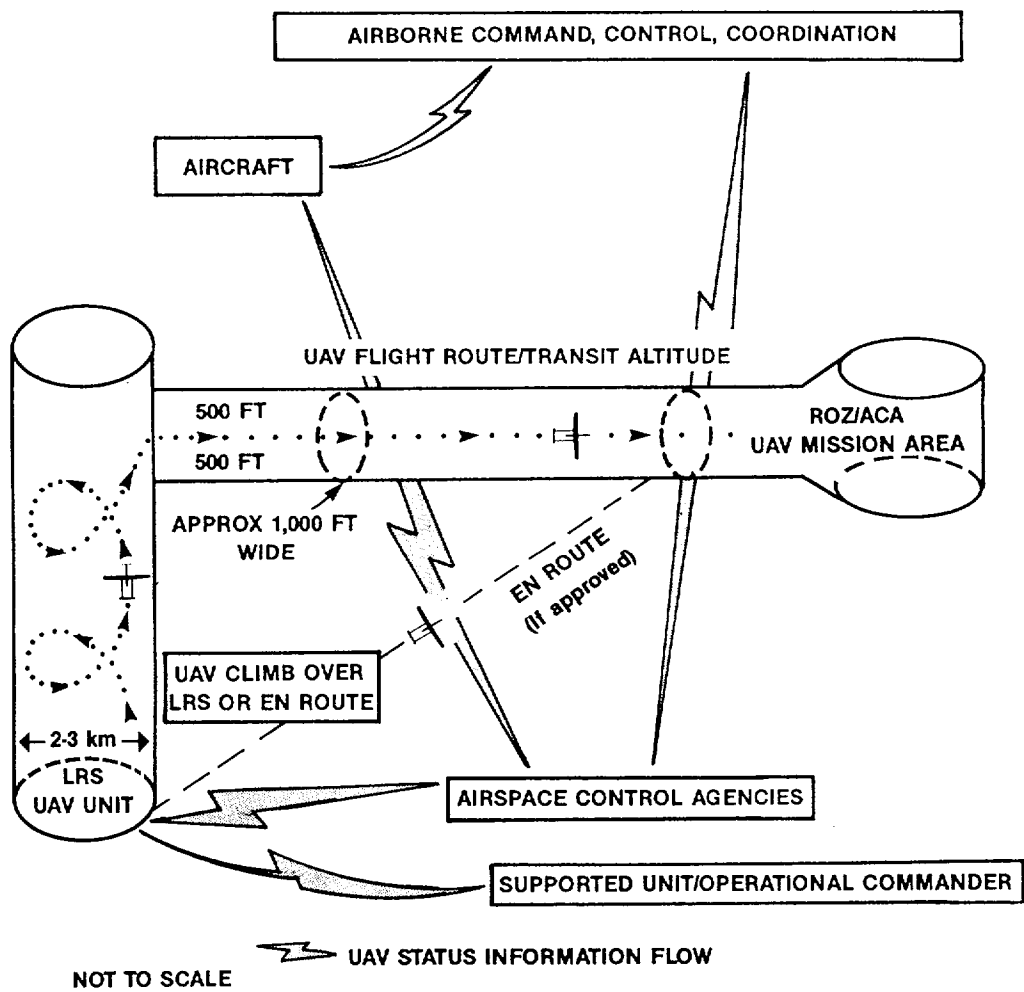


Figure 4-2. UAV Airspace Control Measures.

Positive separation between aircraft and UAVs is required and is the responsibility of the appropriate airspace control agency. This may be accomplished by—

- Activation of temporary airspace coordination areas (ACAs), temporary airport traffic areas (ATAs), temporary terminal control areas (TCAs) or restricted operations zones (ROZs) for UAV takeoffs, landings, and mission areas or flight routes. ROZs are also known as restricted operations areas (ROAs).
- Routing separation via existing air control points. Specific UAV routes may be created by connecting selected air control points together.
- Altitude separation which can be effected by having a set UAV operating altitude or by deconflicting whatever altitude the UAV is flying with other airspace users.
- Any combinations of the above can be used, as required.

The UAV's integration into the airspace is achieved through coordination between the FSCC and DASC during MEF/MEF (forward) operations. During MEU operations, integration is accomplished with the SACC/Navy TACC.

**c. Air Direction.** In the context of UAV employment, the purpose of air direction is to achieve a balance between the use of the MAGTF's finite UAV assets and the ability of the UAV company to accomplish its mission. Inefficient air direction results in poor use of resources and excessive response times. Air direction is usually exercised by the ACE commander through the MACCS. In the case of UAVs, the MAGTF commander (having OPCON over the UAV company) exercises air direction over UAVs

with MACCS agencies. Air direction tasks include but are not limited to the following:

- Developing UAV missions for inclusion into the ATO.
- Fulfilling the requirements of ATOs; i.e., tasking UAVs to perform specific missions.
- Changing or altering a UAV's mission.
- Processing requests for UAV support.
- Collecting information concerning UAV mission status.
- Moving UAV units to new operating sites.
- Adjusting UAV unit mission assignments within previously set parameters due to changes in the air or ground situation.

#### 4004. Collection Tasking Authority

In UAV operations, collection tasking authority is the authority to task the UAV company commander to collect information that will be used as combat information or for the development of intelligence. Collection tasking authority resides with the commander who has OPCON of the UAV company. The results of collection taskings normally fulfill information or intelligence requirements. Intelligence requirements flow from the intelligence sections of the major subordinate commands to the MAGTF G-2/S-2 and on to the SARC where they are incorporated into taskings on behalf of the MAGTF commander for the UAV company. Requirements for operational support, such as assistance in the adjustment of supporting arms fire, go through the operations sections of the major subordinate commands (MSCs) and on to the MAGTF G-3.

## 4005. Communications

To the greatest extent possible, existing doctrinal communication nets are used to connect the UAV company with supported units and airspace management agencies. FMFM 3-30 and the *Marine Corps Tactical Communications Architecture (MCTCA)*, *Midterm*, dated 29 June 1992, provide a description and possible layouts of FMF radio nets. These nets are established to satisfy communication requirements during amphibious operations and subsequent operations ashore. These nets are not intended to preclude the establishment of circuits to meet unique requirements. The GCS is required to maintain appropriate communications with the controlling headquarters and the airspace management agency throughout flight operations. Additional coordination nets may be established between supported units.

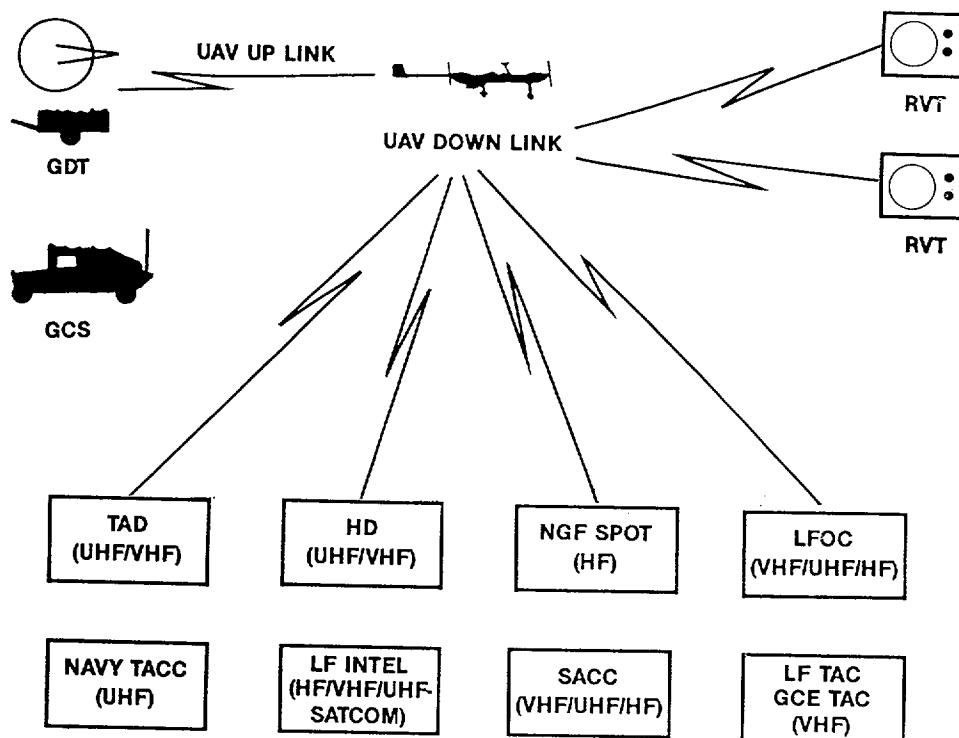
Figures 4-3 and 4-4 are provided as examples of UAV communications connectivity afloat and ashore, respectively. Depicted RVT locations are notional. Actual locations will be designated by the MAGTF or supported unit commander.

a. The following radio links/nets are required for all UAV operations.

**(1) UAV Primary Up Link Control (G-Band).**

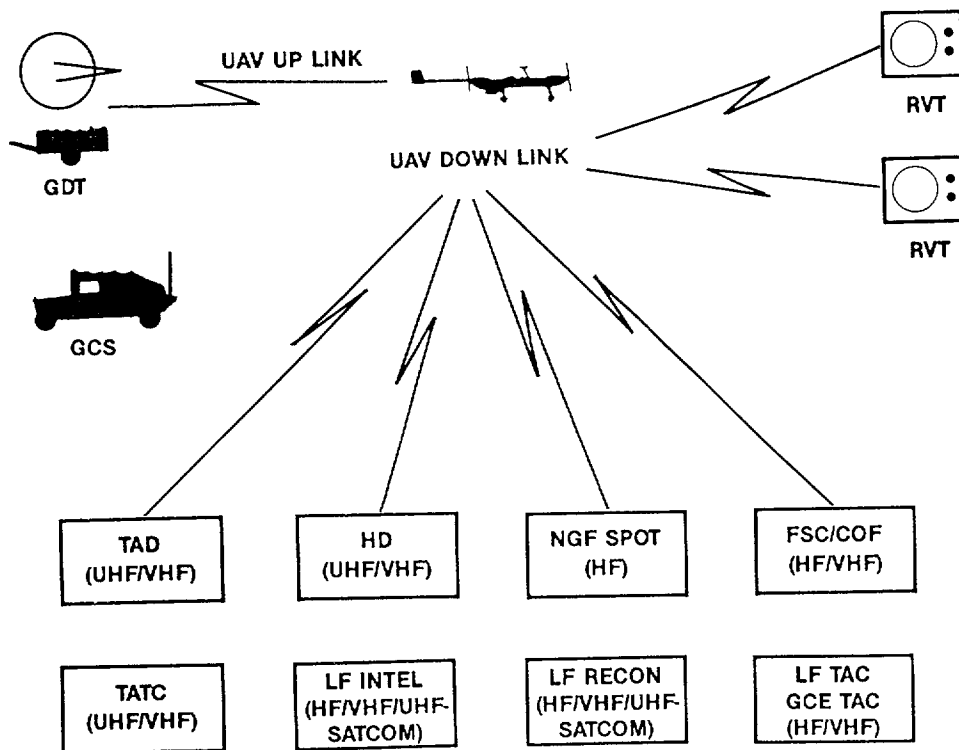
This link from the GDT to the UAV provides signals to control the UAV and payload during flight operations. The link may also be used for L/R operations.

**(2) UAV Secondary Up Link Control.** This link from the GDT or L/R to the UAV provides signals to control the UAV and payload during flight operations if the UAV primary up link control is lost or during L/R.



NOTE: COMMUNICATION INTERFACES ARE NOTIONAL.

Figure 4-3. UAV Communications Afloat.



NOTE: COMMUNICATION INTERFACES ARE NOTIONAL

Figure 4-4. UAV Communications Ashore.

**(3) UAV Telemetry Down Link (G-Band).**

This link provides real-time video display of the target area from the UAV to the MPS/GCS, LRS, and the RVT. It also provides display of down link flight control data to the GCS and LRS.

**(4) UAV Command Net (VHF/UHF).** This net is used by the UAV company/detachment to coordinate UAV activities between the GCS, LRS, and RVT teams. When the LRS is located at an extended distance from a GCS, it may be necessary to establish this net via high frequency (HF) radio. A telephone wire system is installed as the primary communication means between the GCS, LRS, and the RVT(s)/supported unit(s), whenever possible.

**(5) Tactical Air Direction (TAD) (UHF/VHF) or the Tactical Air Traffic Control (TATC) (UHF/VHF) Net.** These two radio nets are the

primary links between the airspace control agency and the GCS/LRS/MPS. These nets may be used by the mission commander or UAV operator to coordinate airspace control during flight operations. Radios in the control stations provide simultaneous monitoring of one of these nets and the international guard frequency. Positive communications between the DASC (or an appropriate air control agency) and the control station is required for all UAV flight operations.

**(6) Landing Force Intelligence (LF INTEL) (HF/VHF/UHF-SATCOM) Net.** This net provides a current situational information exchange with the MAGTF All-Source Fusion Center (MAFC) or the MAGTF SARC. This net is used by the UAV mission commander, MAFC, and the SARC. Whenever possible, wire is the primary communication means among these stations.

**b.** The UAV company has the capability to enter any of the doctrinal voice radio nets identified in FMFM 3-30. When distance or time prevents the establishment of a telephone network, the following radio nets may be established from existing T/E assets.

**(1) Helicopter Direction (HD) (UHF/VHF) Net.** This net is used by the GCS for close coordination between the UAV mission commander and helicopters.

**(2) Naval Gunfire (NGF) Spot (HF) Net.** This net is used by the UAV mission commander to assist the NSFS ship in adjusting NSFS and to provide target damage assessment.

**(3) Fire Support Coordination (FSC) (HF/VHF) Net.** This net is used by the UAV mission commander to coordinate or adjust supporting arms fire through the supported FSCC or artillery unit headquarters.

**(4) Conduct of Fire (COF) (HF/VHF) Net.** This net is used by the UAV mission commander when adjusting artillery missions directly with the artillery battery or battalion.

**(5) Landing Force Reconnaissance (LF RECON) (HF/VHF/UHF-SATCOM) Net.** This net provides for coordination of the reconnaissance effort within the landing force. This net is between the UAV mission commander and the reconnaissance unit. It is used as an alternate communication means to pass critical information from the reconnaissance unit when the doctrinal intelligence net is unavailable.

**(6) Landing Force Tactical (LF TAC) or (GCE TAC) (HF/VHF) Net.** This net can be used to pass FLASH precedence traffic when other means are not available. This net may also be used to aid the GCE commander in maneuver control.

**c.** The RVT provides real-time video displays from a UAV. The location of the

RVTs are at the discretion of the MAGTF or supported commander. The maximum range from UAV to RVT is normally 40 kilometers, and lesser ranges are frequently caused by foliage, atmospheric conditions, or poor LOS factors.

**d.** Frequency allocation and control, especially UAV up link and down link control frequencies, must be carefully coordinated by the MAGTF communications-electronics officer (CEO) to reduce adjacent channel interference and enhance flight safety. The MAGTF electronic warfare officer (EWO) excludes the UAV up and down link control frequencies from any induced friendly interference.

**e.** Communications security (COMSEC) is a principal consideration in all communications planning due to UAV vulnerability to enemy jamming.

## 4006. Operation Plan/Order Outline

Early guidance from the commander on mission tasking authority and mission priorities of the UAV company is important. Early guidance assists the staff in its preparation of estimates, regarding the who, what, when, where, and how connected with the use of UAVs. It also assists in preparation of the operation plan/order. The UAV company commander, or his representative, in his role as a special staff officer, ensures UAV operations are considered in the following annexes prior to initiating UAV operations.

**a. Annex A (Task Organization).** The UAV company is normally placed in support of the MAGTF commander. Individual control stations are attached or assigned to subordinate commands, as appropriate.

**b. Annex B (Intelligence).** Annex B discusses the UAV company's intelligence

collection capability, assigns intelligence missions, and discusses positioning of RVTs to support intelligence requirements. The detailed instructions for employment of the UAV is located in the aerial reconnaissance plan of the reconnaissance and surveillance plan within annex B. An observation plan, employment plan, and employment overlay will be prepared. Samples of these documents are shown in appendix F.

The UAV employment overlay (appendix F), depicting different predesignated flight paths has proven to be a useful planning tool. These flight paths are generated by connecting existing specific air control points. These flight paths are given specific designations. The UAV employment overlay provides a graphic portrayal of UAV flight paths. Use of the overlay assists in combining the flight paths associated with multiple UAV mission requests into a single flight.

**c. Annex C (Operations).** In the conduct of operations paragraph, subparagraphs should discuss mission priorities assigned to the UAV company and tasking procedures. At a minimum, annex C contains directions and coordinating instructions for UAV operations. It addresses missions other than intelligence collection such as adjustment of indirect fire weapons, CAS, etc., as discussed in paragraph 1004. It discusses positioning of RVTs to supported units.

**d. Annex D (Logistics).** Special petroleum, oils, and lubricants (POL)

requirements (i.e., UAV fuel), and UAV peculiar supply support (pack-up kits) should be discussed in this annex.

**e. Annex K (Communications-Electronics).** The UAV company headquarters, the GCS, and the LRS should be provided tactical digital telephone service by the supported unit, as indicated in this annex. Communications links between the UAV company and supported, higher, and adjacent units/agencies should be depicted. Control frequencies must be assigned judiciously to ensure interference-free, UAV flight control.

**f. Annex N (Air Operations).** Airspace coordination and control procedures to maintain separation between manned aircraft and UAVs are explained in this annex.

**g. Annex R (Reports).** This annex should include special reporting procedures to inform the MAGTF commander of the UAV company's status.

## 4007. Liaison

Liaison is defined as "That contact or inter-communication maintained between elements of military forces to ensure mutual understanding and unity of purpose and action." (Joint Pub 1-02) UAV companies/detachments should include liaison personnel to facilitate proper planning and execution of UAV missions at the supported unit.

## Combat Service Support

The UAV company can provide limited CSS in the areas of maintenance, supply, transportation, and health service support. Services and engineering support are provided by the MEF, commander with ADCON, or supported unit. CSS requirements beyond the capability of the UAV company should be considered in planning.

### 5001. Maintenance

The maintenance concept for the SR-UAV system is based on reducing the maintenance and logistics burden placed on the supported commander. The SR-UAV system is critical low density, combat essential. Maintenance consists of fault isolation, access, removal, and repair/replacement of modules and components, calibration, and preventive maintenance to retain/return the system to service.

The current Pioneer UAV system is maintained by both Marines and on-site contractors. When the Hugin system is fielded, depot maintenance will initially be accomplished by contractor. This function will be phased over to a joint depot when it is established. The SR-UAV system will then be exclusively Marine maintained and supported at all levels of maintenance below joint depot level. This will include support during peacetime deployments and combat operations. Maintenance personnel will deploy with UAV companies and/or be so situated as to provide continuous support. Plans are for all maintenance on the SR-UAV system to be accomplished and documented in accordance with maintenance policies outlined in the Marine Integrated Maintenance Management System (MIMMS) series. Marines will be responsible for all maintenance reporting and documentation.

#### a. Organizational Maintenance

(1) **SR-UAV System.** Unit maintenance personnel currently assist the contractor in performing organizational (first and second echelon) maintenance on all components of the SR-UAV system. The contractor is responsible for training maintenance personnel to a level which will permit future military assumption of all UAV organizational (i.e., first through fourth echelon) maintenance responsibilities. Organizational maintenance consists of performing preventive and corrective maintenance on all components of the SR-UAV system. Unit personnel may perform limited intermediate level maintenance (third echelon) on selected components of the system.

(2) **Other Equipment.** The UAV unit performs first and limited second echelon maintenance on organic motor transport, engineering equipment, communication equipment, and other T/E items. Second echelon maintenance of non-UAV equipment, beyond the limited capabilities of the UAV unit, is the responsibility of the MEF or commander with ADCON.

**b. Intermediate Maintenance.** Intermediate maintenance of the SR-UAV system is also performed by Marine personnel. Marine personnel use two levels of intermediate maintenance on the SR-UAV system.

(1) Level one repair consists of fault isolation to the defective shop replaceable assembly (SRA) using built-in test and fault indicators (GO/NO GO) to the maximum extent on the majority of applicable weapon replacement assemblies (WRAs). Faulty SRAs and WRAs that cannot be diagnosed or repaired on site are evacuated to doctrinal

Service UAV intermediate level facilities (force service support group [FSSG], etc.).

(2) Level two repair consists of fault isolating WRAs, SRAs, chassis-mounted components, and wiring harnesses using special support equipment, equipment-unique support equipment, and intermediate maintenance publications. Faulty components are replaced using micro-miniature repair techniques. Level two is performed at the Service's UAV intermediate facilities.

**c. Depot Level.** Depot level repair of UAV components is provided by the joint UAV depot facility. This consists of major repairs or modifications of system components beyond the capabilities of the organizational and intermediate level Marine and contractor maintenance personnel.

**d. Contractor Maintenance.** Currently, the contractor provides material, services, equipment, tools, facilities, and publications to repair, restore, and return to ready for issue/ready for flight condition of the SR-UAV system, subsystem, and components at each level of maintenance.

## 5002. Supply Support

**a.** Supply support is provided by the MEF or commander with ADCON. The objective of supply support is to establish, maintain, and improve combat readiness by ensuring that supply support is available for the UAV system when it becomes operational. In the appropriate echelons of the supply and maintenance system, supply support makes available all spares and repair parts, support and test equipment, and technical assistance required to support the UAV system when it becomes operational. It also ensures that additional stocks are available through routine replenishment.

**b.** Supply support for the SR-UAV system is a contractor responsibility that will become a Marine Corps responsibility on fielding of the Hugin SR-UAV system. Supply support includes acquisition, distribution, provisioning, and inventory replenishment of system components, spares, repair parts, and consumable supplies necessary to maintain the system in a high state of readiness. Supply support for non-UAV systems is provided in accordance with existing Marine Corps policies for provisioning and supplies. Supply responsibility is shared by the Marine Corps logistics base and the supported commander. Initial spares support is provided by contract for SR-UAV system-unique items.

**c.** Classes of supply requiring special considerations are as follows:

(1) **Class III—Fuel.** Besides standard POL requirements for T/E items, the UAV requires 87 octane motor gasoline (MOGAS) UAV fuel and Mobil 1 engine oil.

(2) **Class V—Ordnance.** If RATO launch is planned, provision for the storage, transportation, and use of rocket assemblies must be made. Also, if ordnance-induced activation devices are used to deploy emergency systems, such as parachutes, provision must be made for use of these devices.

(3) **Class IX—Repair Parts.** Under current arrangements, the contractor is contractually obligated to provide operational spares, 30-day pack-up kits for extended training, and 90-day pack-up kits for deployment. Stockage for the UAV system will not be loaded into the inventory system. In an operational situation, the MEF or commander with ADCON will also provide for the evacuation of parts which are beyond the capability to repair at the unit level. Commanders may have to provide transportation of evacuated materials to CONUS.



Once items reach CONUS, the contractor will provide transportation to the depot maintenance facility.

### **5003. Engineer Support**

In those instances where a suitable site for the conduct of UAV operations (75 ft x 1500 ft) cannot be located, engineer support will be required for site preparation. If paved runways, improved roads (asphalt or concrete) and unimproved roads (hard dirt, etc.) are available, then they can be used for takeoff and landing operations. In this case, engineering support will not be required.

### **5004. Transportation**

The UAV company is transportable by rail, sea, and air. All items are helicopter-transportable with some disassembly required. The UAV unit T/E provides sufficient organic motor transport to move the entire unit over road and across country.

### **5005. Firepower**

The UAV company has organic small arms for self defense. It requires security forces from the supported unit if the situation calls for a defensive posture.

### **5006. Medical**

Medical support is provided by the MEF or commander with ADCON. The UAV company has a corpsman for minor injuries and emergency treatment. It relies on the MEF, commander with ADCON, or the supported unit for further medical support.

### **5007. Messing**

The UAV company does not have a messing capability. It receives its messing support from the supported unit, the MEF, or the commander with ADCON.

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## Chapter 6

# Training

Responsibility for training is shared by the U.S. Army Intelligence Training Center located at Fort Huachuca, Arizona and the Marine Corps. Training covers all aspects of maintenance and related operator functions. Marine Corps responsibility includes tactical training for individuals, the unit, and MAGTF operations.

## 6001. Types of Training

**a. Maintenance Training.** Maintenance personnel, MOS 9815 and 9816, undergo a course of formal schooling or on-the-job training (OJT) which consists of classroom instruction and repair of the UAV sub-systems. Included as part of that training are courses on the SR-UAV component parts such as the GDT, UAV, GCS, and the various payloads to be utilized. Training time is devoted to shop and field maintenance.

**b. Operator Training.** Operator training specifically covers the internal and external pilots and the operation of the payload(s).

**(1) External UAV Operator.** The external operator, MOS 9814, controls the takeoff and landing phases of UAV flights. These pilot trainees need a maximum of 26 weeks of training. Refresher training for experienced UAV pilots requires about 4-6 weeks. The full course consists of four modules.

- Basic radio-controlled (RC) model flight.
- Advanced RC model flight.
- Half-scale UAV flight.
- Full-scale UAV flight.

**(2) Internal Pilot.** The internal pilot, MOS 9808, executes the mission, which includes controlling the UAV flight path, navigation, payload operation, and degraded flight profiles. Training is comprised of both classroom and practical application sessions. OJT consists of flight tasks designed to allow trainees the opportunity to demonstrate their understanding of the system functions. Initial qualifications of internal pilots requires approximately eight weeks.

**(3) Payload Operator.** Initial payload operator, MOS 9813, training covers the mechanical aspects involved in operating the payload. The Marine Corps provides the military-related operational training in target recognition and adjustment of fires.

**(4) Remote Video Terminal Operator.** The RVT operator, MOS 9817, sets up and executes RVT operations to support designated units in receiving UAV imagery. He is also familiar with basic equipment preventive maintenance and communications skills.

**(5) Mission Commander.** The mission commander, MOS 9807, receives formal schooling or is trained at the unit level. He is knowledgeable in all phases of the UAV operation. He will have undergone related training, such as airspace command and control, and demonstrated a thorough understanding of the tactical employment of the SR-UAV. The company commander has the authority to designate mission commanders.

**c. Unit Training.** Unit training is composed of both UAV and non-UAV related training. It enables the unit to function smoothly in all phases of operations. As experience and operation of the SR-UAV system grows, individuals will begin to

develop as a team and apply their basic skills to all phases of operation. Training in non-UAV related areas such as NBC defense, camouflage, etc., must also be addressed and is the unit commander's responsibility. Once the technical portions of UAV training are integrated with non-UAV related training, the unit is ready for tactical employment.

**d. MAGTF Training.** After the unit is operational and functioning smoothly, it must be integrated into MAGTF training. Commanders are encouraged to be imaginative and employ the UAV in all phases of their operations. Evolutions should be scheduled so that operators can maintain a high level of proficiency during the conduct of UAV operations. Training exercises should include a wide variety of battlefield scenarios. The goal is to present operators with experience in as many tactical situations as possible. Various means of command and control, message formats for reporting, and types of missions should be rehearsed under different conditions. Training successes and failures should be documented.

The following are examples of UAV employment in training exercises:

- Employ UAVs against *friendly* forces as well as *enemy* forces.
- Dedicate the UAV assets to a single agency or element (e.g., FSCC, COC, ACE) for a period of time.
- Effect extended and *surge* operations to test the adequacy of internal procedures and organization.
- Accomplish reduced-visibility L/R operations.

- Execute displacement training in day/night and all weather conditions.
- Perform multiple flight/mission operations.
- Conduct operations individually with MAGTF agencies or elements (e.g., FSCC, COC, ACE, GCE, CSSE, SPF).

## 6002. Reports

When a UAV company participates in an exercise or operational environment, supported units and the UAV company will submit an after action report via the appropriate chain of command to the Commanding General, Marine Corps Combat Development Command (MCCDC), C 44, Quantico, Virginia 22134. Other applicable agencies should be information addressees on the report.

The report will include discussion on the use of the current COE and any recommended additions, deletions, and/or improvements to the COE. The report will be added to the Marine Corps Lessons Learned System (MCLLS) to provide a continuing UAV data base for the development of operations and equipment.

MCCDC will chair a standing UAV COE working group to review these reports, as required. In addition to MCCDC representation, the working group will consist of a single voting representative from Fleet Marine Force, Atlantic (FMFLant), Fleet Marine Force, Pacific (FMFPac), and Marine Aviation Weapons and Tactics Squadron-One (MAWTS-1). Recommendations of the COE working group will be considered for review, staffing, and revisions to the COE.

## Appendix A

# UAV Company Table of Organization

Line No.	Description	Grade	MOS	Off	Enl
1	Company Headquarters				
2	Company Commander	Maj	9910	1	
3	Executive Officer	Capt	7208	1	
4	First Sergeant	1stSgt	9999		1
5	Admin Clerk	LCpl	0151		2
6	Operations Section				
7	Operations Officer	Capt	0802/9960	1	
8	Operations Chief	GySgt	0848		1
9	UAV Liaison Officer	Lt	9910	1	
10	Liaison Chief/Sr Pay Officer	SSgt	0861		1
11	Fire Support Asst	LCpl	0844		1
12	Intel Section				
13	Intel Officer	Lt	0202	1	
14	Intel Chief	SSgt	0231		1
15	Intel Spec/Analyst	Sgt	0231		3
16	Intel Spec/Analyst	Cpl	0231		3
17	Comm Section				
18	Radio Chief	Sgt	2537		1
19	Radio Operator	LCpl	2531		6
20	Support Section				
21	MT Ops Chief	SSgt	3537		1
22	MMS Clerk	Cpl	0411		1
23	Supply Chief	Cpl	3043		2
24	Driver	LCpl	3531		12
25	Medical Section				
26	Corpsman	HM2	8404		3
<b>Section Totals</b>					
<b>Marine</b> .....				<b>5</b>	<b>36</b>
<b>Navy</b> .....					<b>3</b>
27	Maintenance Platoon				
28	Maintenance Platoon Cmdr	CWO2	2830	1	
29	Maintenance Chief	MSgt	2891		1
30	Electronic Maintenance	Tech Sgt	9815		3
31	Electronic Maintenance Tech	Cpl	9815		3
32	Electronic Maintenance Tech	Sgt	9815		3
33	Electronic Maintenance Tech	Cpl	9815		3
34	Electronic Maintenance Tech	Cpl	9815		6
35	Mechanic Maintenance Tech	Sgt	9816		3
36	Mechanic Maintenance Tech	Cpl	9816		3
37	Mechanic Maintenance Tech	LCpl	9816		3
38	Generator Mechanic	Cpl	1142		4
<b>Section Totals</b>					
<b>Marine</b> .....				<b>1</b>	<b>32</b>

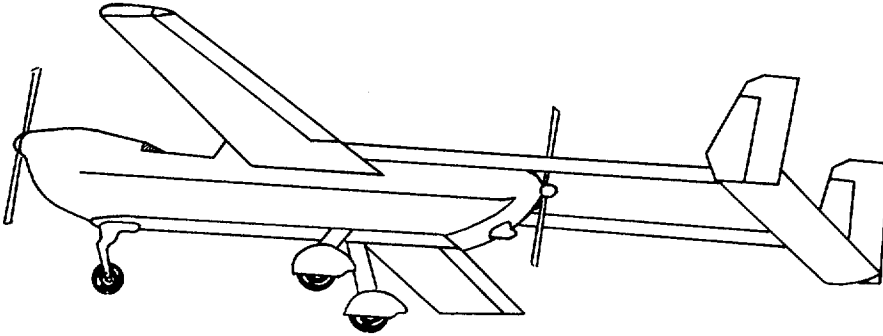
39	UAV Flight Platoon (3 each)				
40	Plat Cmdr/Aviation Coord	Capt	9969	1	
41	Mission Commander	Lt	9807	1	
42	Internal Pilot	SSgt	9808		4
43	External UAV Operator	SSgt	9814		2
44	Payload Operator	Cpl	9813		2
45	Payload Operator	LCpl	9813		2
46	Radio Operator	Sgt	2531		1
47	Radio Operator	LCpl	2531		3
48	RVT Operator	LCpl	9817		2
<b>Section Totals</b>					
	<b>Marine</b>			2	16
<b>Organization Totals</b>					
	<b>Marine</b>			12	116
	<b>Navy</b>				3

**Footnote Section:**

1. Line 28 suitable substitution MOS 2805.
2. Lines 30-34 maintain MPS, GCS, GDT, or UAV as primary duty.
3. Lines 35-37 suitable substitution MOS 3524.
4. Lines 35-37 maintain UAV as primary duty.
5. MOS 9807 additional to primary 7208/9969.
6. MOS 9808 additional to primary 9969/9916.
7. MOS 9813 additional to primary 0861/0231.
8. MOS 9814 additional to primary 9916.
9. MOS 9815 additional to primary 2887/2821/2821/2841.
10. MOS 9816 additional to primary 3522.
11. MOS 9817 additional to primary 2531.

## Appendix B

# General Characteristics of SR-UAV



### EXTERNAL DIMENSIONS:

Wing span .....	8.8 meters/29 feet
Length, overall .....	6.97 meters/23 feet
Height, overall .....	1.7 meters/5.6 feet

### WEIGHTS:

UAV .....	531.8 kilograms/1,170 pounds
Maximum payload .....	90.9 kilograms/200 pounds
Full fuel tank .....	104.5 kilograms/230 pounds
Maximum takeoff weight .....	727.3 kilograms/1,600 pounds

### PERFORMANCE:

Dash speed .....	110 knots TAS at 10,000 feet
Optimal cruise velocity .....	90 knots
Maximum dive velocity .....	150 knots
Stall speed .....	40–50 knots
Takeoff velocity .....	55 knots
Landing velocity .....	55 knots
Maximum altitude .....	classified
Maximum takeoff/landing altitude .....	10,000 feet
Flight endurance .....	classified
Flight radius of action .....	classified
Engine .....	65 horsepower per engine (130 horsepower total)
Fuel .....	MOGAS (87 octane)
Oil type .....	MOBIL 1

### LAUNCH AND RECOVERY:

Rolling takeoff .....	300 meters
Rocket-assisted takeoff .....	0 distance
Arrested recovery:	
Normal operations .....	70 meters
Special circumstances .....	70 meters
Rolling recovery .....	400 meters

### ENVIRONMENTAL RESTRICTIONS:

Temperature range .....	–25 °F to +125 °F (–4 °C to +51 °C)
Rain .....	2 inches per hour with 35 knot winds
Icing conditions .....	operational within 1.5 hours with ice load of 3 pounds per square foot
Wind .....	up to 35 knots
Crosswind limitations on takeoff .....	25 knots

(reverse blank)

## Appendix C

# Payload Specifications

### DAY SENSOR:

#### Camera and optics:

Diameter .....	213mm L × 183H × 75W
Electronics assembly .....	87mm L × 69H × 45W
Raster format .....	525 line standard TV
Effective camera tube area .....	6mm × 4.5mm
Spectral sensitivity .....	.4 to 1.06mm
Beam expander ratio .....	None

#### Zoom lens:

Focal length .....	10mm to 150mm
--------------------	---------------

#### Automatic Iris control ratio:

F-number (narrow) .....	f2.3 to f22
F-number (wide) .....	f2.8 to f22

Iris speed .....	4 seconds
------------------	-----------

#### Field of view (FOV):

Narrow .....	2.3°
Wide .....	33.4°

#### Zoom control speed

#### Focus speed

#### Day sensor capabilities

### NIGHT SENSOR (FLIR):

#### Field of view performance:

Super narrow FOV .....	1° × .75°
Narrow FOV .....	2° × 1.5°
Medium FOV .....	7.1° × 5.6°
Wide FOV .....	24.7° × 18.6°

Entrance aperture .....	150mm
-------------------------	-------

F-number for all FOV .....	1.2
----------------------------	-----

Spectral bypass .....	8-12 microns
-----------------------	--------------

Detector type .....	(HgCd)Te 120 array
---------------------	--------------------

Cooling type .....	Closed cycle, Starling
--------------------	------------------------

Cool down time .....	3 to 4 minutes nominal
----------------------	------------------------

Frame rate/field rate .....	30/60 Hz or 25/50 Hz
-----------------------------	----------------------

Scan rate .....	50 Hz or 60 Hz
-----------------	----------------

IR lines per frame .....	700 × 240
--------------------------	-----------

Operating range .....	± 25°
-----------------------	-------

### AIR DATA RELAY (ADR):

Weight .....	1.8 kilograms/4 pounds
--------------	------------------------

Maximum range to penetrator .....	75 kilometers
-----------------------------------	---------------

#### Omni-down link range

GDT to air data terminal (ADT) .....	50 kilometers
--------------------------------------	---------------

ADT to RVT .....	40 kilometers
------------------	---------------

ADT to GDT .....	50 kilometers
------------------	---------------

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## Appendix D

# Joint Tactical Air Reconnaissance/ Surveillance Request Form

JOINT TACTICAL AIR RECONNAISSANCE/ SURVEILLANCE REQUEST FORM		See JCS Pub L2, Vol II, for instructions for preparation	
①	REQUEST NO. _____	PREPLANNED A. PRIORITY _____ IMMEDIATE C. PRIORITY _____	8. PRECEDENCE _____
	DATE/TIME FACTORS: 1. DATE MISSION DESIRED _____ 2. TOT (IF REQ) _____		FROM _____
M	3. LTIOV _____	4. PRIOR COVERAGE ACCEPTABLE (DAYS PRIOR) _____	TO: _____
N	TYPE RECON REQUESTED:		<input type="checkbox"/> APPROVED
	1. TYPE MISSION: A. VISUAL B. IMAGERY C. ELECTRONIC D. WX		<input type="checkbox"/> DISAPPROVED
	2. TYPE COVERAGE: A. PINPT B. STRIP/LOC C. RT. RECCE D. AREA SEARCH E. AREA COVER F. AFLOAT		BY/REASON _____
	* 3. SENSOR: A. OPTICAL B. IR C. SLAR D. ELECTRONIC E. LASER F. OTHER		SENT _____
	* 4. TYPE PHOTO: A. VERT B. OBLIQUE C. PAN		TIME _____ BY _____
	* 5. TYPE FILM: A. BLACK AND WHITE B. COLOR C. CAMFLG DET.		RECEIVED _____
6. STEREO PHOTO: A. NOT REQ'D B. REQUIRED _____		TIME _____ BY _____	CHECKED BY _____
②	MAP REFERENCE: TYPE AND SCALE _____		ACKNOWLEDGED _____
③	SERIES _____ SHEET _____ EDITION _____ DATE _____		BDE REGT _____
	TARGET COORDINATES:		DIV _____
	1. UTM _____		CORPS _____
④	2. LAT/LONG _____		OTHER _____
	3. OTHER (SPECIFY) _____		COORDINATION _____
	TARGET CATEGORY / EEI: (SEE EEI ON REVERSE SIDE)		RCVD _____
⑤	1. AIRFIELD _____		DTG _____
	2. ARMOR/ARTY/TROOPS/VEHICLES _____		BY (G-2) _____ (AIU) _____
	3. BRIDGE _____		DTG _____
	4. DEFENSIVE POS/STRONG PT/GUN _____		COORDINATED _____
	5. ELECTRONIC SITE _____		<input type="checkbox"/> FSE
	6. HARBOR/PORT FACILITY _____		<input type="checkbox"/> AIR DEF
	7. INDUSTRIAL SITE _____		<input type="checkbox"/> AVN
	8. LOC _____		<input type="checkbox"/> NGF
⑥	REPORTS: 1. INFLT (CS/FREQ) _____ VALID FROM _____ Z TO _____ Z		NOTIFIED _____
⑦	2. MISREP 3. HOTPHOTOREP 4. IPR 5. SUPR _____ VALID FROM _____ Z TO _____ Z		<input type="checkbox"/> MIBARS
	IMAGERY PRODUCTS (IF REQUIRED) _____		<input type="checkbox"/> II
T	DELIVERY ADDRESS: 1. UNIT _____		BY _____ DTG _____
	* 2. AIR DROP (IF REQ): COORDS _____		REQUESTING UNIT _____
U	CALL SIGN/FREQ _____		NOTIFIED BY _____
	RUN-IN HEADING (MAG) (OPTIONAL) _____		DTG _____
	REMARKS/SPECIAL INSTRUCTIONS:		AIR ACTION _____
V	* 1. TARGET AREA CONTROL: (CALL SIGN/FREQ) _____		NOT AT _____
	2. OTHER _____		BY _____ DTG _____
	1. RESTRICTIVE FIRE/AIR PLAN		<input type="checkbox"/> ACCEPT
W	[A] IS NOT [B] NO.		<input type="checkbox"/> REFUSE
	2. IN EFFECT		REASON _____
	3. LOCATION		
W	4. WIDTH (METERS)		
	5. ALTITUDE/VERTEX		
	6. CONT PT/ROV (COORD/NAV AID)		
7. INITIAL CONTACT			
8. FINAL CONT (TACP/FAQ) C/S FREQ			
9. RESTRICTIVE FIRE/AIR PLAN SEE BLOCK V			
10. TGT DESCRIPTION			
11. TGT COORD/ELEV			

\* Asterisk indicates use as applicable or when known.  
 ○ Encircled line designators are minimum mandatory items for immediate requests.

DD FORM 1975

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# Joint Tactical Air Strike Request Form

JOINT TACTICAL AIR STRIKE REQUEST				See JCS Pub 12, Vol II, for instructions for preparation	
SECTION I - MISSION REQUEST				DATE	
1. UNIT CALLED		THIS IS		REQUEST NUMBER	
				SENT	
				TIME BY	
PREPLANNED: <input type="checkbox"/> A		PRECEDENCE <input type="checkbox"/> B		PRIORITY	
IMMEDIATE: <input type="checkbox"/> C		PRIORITY		RECEIVED	
				TIME BY	
TARGET IS/NUMBER OF					
<input type="checkbox"/> A PERS IN OPEN		<input type="checkbox"/> B PERS DUG IN		<input type="checkbox"/> C WPNS/MGR/RA/T	
<input type="checkbox"/> D AAA ADA		<input type="checkbox"/> E RKTS MISSILE		<input type="checkbox"/> F MORTARS, ARTY	
<input type="checkbox"/> G BLDGS		<input type="checkbox"/> H BRIDGES		<input type="checkbox"/> I VEHICLES	
<input type="checkbox"/> J CENTER (CP, COM)		<input type="checkbox"/> K AREA		<input type="checkbox"/> L SUPPLIES, EQUIP	
<input type="checkbox"/> M REMARKS		<input type="checkbox"/> N ROUTE		<input type="checkbox"/> O MOVING NEWS	
TARGET LOCATION IS					
<input type="checkbox"/> A (COORDINATES)		<input type="checkbox"/> B (COORDINATES)		<input type="checkbox"/> C (COORDINATES)	
<input type="checkbox"/> D TGT ELEV		<input type="checkbox"/> E SHEET NO		<input type="checkbox"/> F SERIES	
				<input type="checkbox"/> G CHART NO.	
CHECKED BY					
TARGET TIME/DATE					
<input type="checkbox"/> A ASAP		<input type="checkbox"/> B NLT		<input type="checkbox"/> C AT	
				<input type="checkbox"/> D TO	
DESIRED ORD/RESULTS					
<input type="checkbox"/> A DESTROY		<input type="checkbox"/> B NEUTRALIZE		<input type="checkbox"/> C ORDNANCE	
				<input type="checkbox"/> D HARASS/INTERDICT	
FINAL CONTROL					
<input type="checkbox"/> A FAC/RABFAC		<input type="checkbox"/> B CALL SIGN		<input type="checkbox"/> C FREQ	
<input type="checkbox"/> D ASRT		<input type="checkbox"/> E *FREQ		<input type="checkbox"/> F FIX/CONT PT	
REMARKS					
<div style="border: 1px solid black; padding: 2px; display: inline-block;"> ACKNOWLEDGED  80E/REGT  DIVISION  OTHER </div>					
SECTION II - COORDINATION					
9. NGF		10. ARTY		11. AIO/G-2/G-3	
12. REQUEST <input type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED		13. BY		14. REASON FOR DISAPPROVAL	
15. RESTRICTIVE FIRE/AIR PLAN <input type="checkbox"/> A IS NOT		<input type="checkbox"/> B NUMBER		16. IS IN EFFECT <input type="checkbox"/> A (FROM TIME) <input type="checkbox"/> B (TO TIME)	
17. LOCATION <input type="checkbox"/> A (FROM COORDINATES) <input type="checkbox"/> B (TO COORDINATES)		18. WIDTH (METERS)		19. ALTITUDE/VERTEX <input type="checkbox"/> A (MAXIMUM/VERTEX) <input type="checkbox"/> B (MINIMUM/)	
SECTION III - MISSION DATA					
20. MISSION NUMBER		21. CALL SIGN		22. NO. AND TYPE AIRCRAFT	
23. ORDNANCE		24. EST/ACT TAKOFF		25. EST TOT	
26. CONT PT / RD/NVS (COORD / NAV/AD FIX)		27. INITIAL CONTACT		28. FAC/ASRT/TAC (A) CALL SIGN FREQ	
29. RESTRICTIVE FIRE/AIR PLAN SEE 15-19		30. TGT DESCRIPTION		*31. TGT COORD/ELEV	
32.					
<div style="border: 1px solid black; padding: 2px; display: inline-block;"> ACKNOWLEDGED  TUOC  CRC  TACD  ASRT </div>					

\*TRANS: HIT AS APPROPRIATE

DD Form 1772, APR 75

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## Appendix F

# Sample Tabs to Aerial Observation Plan

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### CLASSIFICATION

Copy no. \_\_\_\_ of \_\_\_\_ copies  
Headquarters, (MAGTF)  
PLACE OF ISSUE  
Date/time of issue

EXHIBIT 4 TO TAB D (AERIAL RECONNAISSANCE PLAN) TO APPENDIX I (RECONNAISSANCE AND SURVEILLANCE PLAN) TO ANNEX B (INTELLIGENCE) TO MAGTF OPOD XXX UNMANNED AERIAL VEHICLE (UAV) OBSERVATION PLAN

Ref: (a) Maps and Charts, Annex M  
(b) FMFM 3-21

1. ( ) **MISSION.** Conduct real-time surveillance, target acquisition, and optical intelligence throughout the (MAGTF) area of responsibility (AOR) until termination of hostilities. Review references (a) and (b).
2. ( ) **EXECUTION.** The UAV company will provide UAV and control crews in support of ground operations within the (MAGTF) AOR. (Designated unit will exercise operational control of all tactical surveillance UAV's within the AOR unless otherwise directed.)
3. ( ) **TASKS.** (Designated unit will:)
  - a. ( ) Prepare an observation plan and overlay to depict UAV concept of employment supporting combat operations ashore and submit to MAGTF.
  - b. ( ) Assign surveillance UAV's, equipment, and personnel to provide real-time video intelligence in support of GCE, ACE, and CSSE operations as directed by this annex and daily fragmentary orders.
  - c. ( ) Provide remote receiving stations at designated locations afloat and ashore.
  - d. ( ) Initiate action to obtain approved frequencies for UAV support.
  - e. ( ) Coordinate flight operations through appropriate air control agencies.
4. ( ) **MARINE FORCES UAV SURVEILLANCE SECTORS/ROUTES.** To facilitate the assignment and coordination of tactical surveillance mission, UAV loiter areas, and surveillance routes are designated in Exhibit 5 (UAV Employment Plan).

(Page number)

CLASSIFICATION

## CLASSIFICATION

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EXHIBIT 5 TO TAB D (AERIAL RECONNAISSANCE PLAN) TO APPENDIX 8 (RECONNAISSANCE  
 AND SURVEILLANCE PLAN) TO ANNEX B (INTELLIGENCE) TO MAGTF OPOD XXX  
 UNMANNED AERIAL VEHICLE (UAV) EMPLOYMENT PLAN

Ref: (a) Maps and Charts, Annex M

1. ( ) The following UAV loiter areas and surveillance routes have been preplanned.

MSN NUMBER	COORDINATES	ALT	TOT	
(UNIT) LA001	18STP901262 TO 18STP861352 TO 18STP961402 TO 18SUP001322 TO CLOSE	TBD	TBD	1, 2, 3
(UNIT) LA002	18SUP102373 TO 18SUP102403 TO 18SUP162422 TO 18SUP172383 TO CLOSE	TBD	TBD	1, 3
(UNIT) LA003	18SUP464445 TO 18SUP464465 TO 18SUP504454 TO 18SUP504425 TO CLOSE	TBD	TBD	1, 3
(UNIT) LA004	18SUP756607 TO 18SUP746635 TO 18SUP786645 TO 18SUP786607 TO CLOSE	TBD	TBD	1, 2, 3

## NOTES:

- (1) ( ) Determine enemy activity and defensive positions.
- (2) ( ) Determine enemy activity along route.
- (3) ( ) To be flown 90 minutes after sunrise to 90 minutes before sunset.

(Page number)

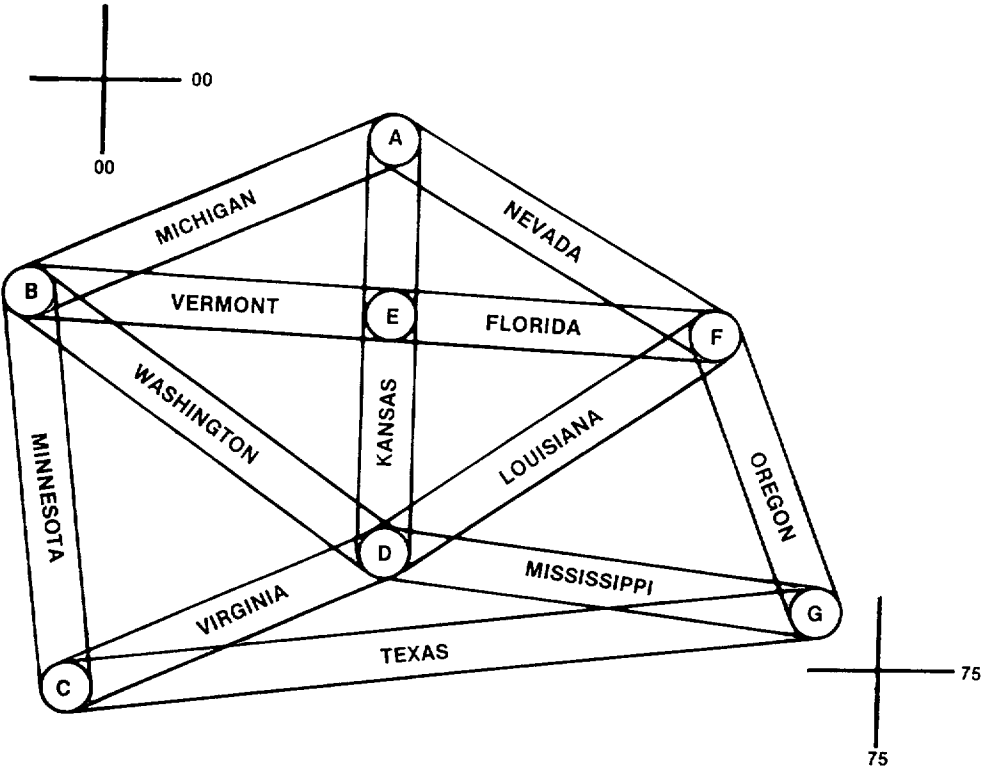
CLASSIFICATION

CLASSIFICATION

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Headquarters, (MAGTF)  
PLACE OF ISSUE  
Date/time of issue

EXHIBIT 6 TO TAB D (AERIAL RECONNAISSANCE PLAN) TO APPENDIX 8 (RECONNAISSANCE AND SURVEILLANCE PLAN) TO ANNEX B (INTELLIGENCE) TO MAGTF OPORD XXX UNMANNED AERIAL VEHICLE (UAV) EMPLOYMENT OVERLAY

Ref: (a) Maps; Joint Operations Graphic (Air) (Number)



(Page number)

CLASSIFICATION

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MACCS .....	Marine air command and control system	RF .....	radio frequency
MAFC .....	MAGTF all-source fusion center	ROA .....	restricted operations area
MAGTF .....	Marine Air-Ground Task Force	ROZ .....	restricted operations zone
MAWTS-1 .....	Marine Aviation Weapons and Tactics Squadron-One	RSTA .....	reconnaissance, surveillance, and target acquisition
MCCDC .....	Marine Corps Combat Development Command	RTB .....	return to base
MCLLS .....	Marine Corps Lessons Learned System	RVT .....	remote video terminal
MEF .....	Marine expeditionary force	SACC .....	supporting arms coordination center
MEU .....	Marine expeditionary unit	SAM .....	surface-to-air missile
MIMMS .....	Marine Integrated Maintenance Management System	SARC ....	surveillance and reconnaissance center
MMF .....	mobile maintenance facility	SATCOM .....	satellite communications
MOGAS .....	motor gasoline	SAW .....	surface-to-air weapon
MOS .....	military occupational specialty	SPF .....	special purpose forces
MPCS .....	mission planning and control station	SRA .....	shop replaceable assembly
MPS .....	mission planning station	SR-UAV ....	short-range unmanned aerial vehicle
MSC .....	major subordinate command		
		tac .....	tactical
NBC .....	nuclear, biological, and chemical	TACC .....	tactical air control center (Navy); tactical air command center (Marine Corps)
NGF .....	naval gunfire	TACON .....	tactical control
NSFS .....	naval surface fire support	TAD .....	tactical air direction
NTACS .....	Navy tactical air control system	TAOC .....	tactical air operations center
		TATC .....	tactical air traffic control
OAAW .....	offensive anti-air warfare	TCA .....	terminal control area
OJT .....	on-the-job training	T/E .....	table of equipment
OPCON .....	operational control	T/O .....	table of organization
OPORD .....	operation order		
		UAV .....	unmanned aerial vehicle
POL .....	petroleum, oils, and lubricants	UHF .....	ultrahigh frequency
		VHF .....	very high frequency
RATO .....	rocket assisted takeoff	WRA .....	weapon replacement assembly
RC .....	radio controlled		
recon .....	reconnaissance		

## Section II. Definitions

### A

**air control**—The authority to effect the maneuver of aircraft. The elements of air control are: air control agency, air controller, airspace control, operational control, positive control, procedural control, radar control, and terminal control. (FMFRP 0-14 under “Marine air command and control system”) Air control is the authority to direct the physical maneuver of aircraft in flight or to direct an aircraft or SAW unit to engage a specific target. (FMFM 5-60)

**air control agency**—An organization possessing the capability to exercise air control. (FMFRP 0-14 under “Marine air command and control system”)

**air defense**—All defensive measures designed to destroy attacking enemy aircraft or missiles in the earth’s envelope of atmosphere, or to nullify or reduce the effectiveness of such attack. (Joint Pub 1-02)

**air defense warning conditions**—A degree of air raid probability according to the following code. The term air defense division/sector referred to herein may include forces and units afloat and/or deployed to forward areas, as applicable. (Extract from Joint Pub 1-02)

**air defense warning red**—Attack by hostile aircraft and/or missiles is imminent or is in progress. This means that hostile aircraft and/or missiles are within an air defense division/sector or are in the immediate vicinity of an air defense division/sector with high probability of entering the division/sector. (Joint Pub 1-02)

**air defense warning white**—Attack by hostile aircraft and/or missiles is improbable. May be called either before or after air defense warning yellow or red. The initial declaration of air defense emergency will automatically establish a condition of air defense warning other than white for purposes of security control of air traffic. (Joint Pub 1-02)

**air defense warning yellow**—Attack by hostile aircraft and/or missiles is probable. This means that hostile aircraft and/or missiles are en route toward an air defense division/sector, or unknown aircraft and/or missiles suspected to be hostile are en route toward or are within an air defense division/sector. (Joint Pub 1-02)

**air direction**—The guidance and supervision which a commander employs to focus his resources on mission accomplishment. Air direction occurs as a sequence of the following activities: apportionment, allocation, tasking, and fragmentary order. (FMFRP 0-14 under “Marine air command and control system”) The authority to regulate the employment of air resources (aircraft and SAW units) to maintain a balance between their availability and the priorities assigned for their usage. (FMFM 5-60)

**air reconnaissance**—The acquisition of intelligence information by employing visual observation and/or sensors in air vehicles. (Joint Pub 1-02)

**airport traffic area**—Unless otherwise specifically designated, that airspace within a horizontal radius of five statute miles from the geographic center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of the airport. (Joint Pub 1-02) Also called ATA.

**airspace control**—A service provided in the combat zone to increase operational effectiveness, by promoting the safe, efficient, and flexible use of airspace. Airspace control is provided in order to permit greater flexibility of operations, while authority to approve, disapprove, or deny combat operations is vested only in the operational commander. (Joint Pub 1-02) A service which coordinates, integrates, and regulates the use of an airspace of defined proportions. It does not include measures to approve, disapprove, deny, or delay air operations. (FMFRP 0-14 under “Marine air command and control system”)

- a. **counter C<sup>2</sup>**—To prevent effective C<sup>2</sup> of adversary forces by denying information to, influencing, degrading or destroying the adversary C<sup>2</sup> system.
- b. **C<sup>2</sup> protection**—To maintain effective command and control of own forces by turning to friendly advantage or negating adversary efforts to deny information to, influence, degrade or destroy the friendly C<sup>2</sup> system.

(approved for inclusion in Joint Pub 1-02 as a replacement for C<sup>3</sup>CM).

**control**—Authority which may be less than full command exercised by a commander over part of the activities of subordinate or other organizations. (Joint Pub 1-02) (Part 1 of a 4-part definition.)

**control of aircraft and missiles**—The coordinated employment of facilities, equipment, communications, procedures, and personnel which allows the ACE commander to plan, direct, and control the efforts of the ACE to support the accomplishment of the MAGTF's mission. (FMFM 5-60)

**coordinating altitude**—A procedural airspace control method to separate fixed- and rotary-wing aircraft by determining an altitude below which fixed-wing aircraft will normally not fly and above which rotary-wing aircraft normally will not fly. The coordinating altitude is normally specified in the airspace control plan and may include a buffer zone for small altitude deviations. (Joint Test Pub 3-52) Used with US Army helicopters.

**coordination**—The action necessary to ensure adequately integrated relationships between separate organizations located in the same area. Coordination may include such matters as: fire support, emergency defense measures, area intelligence, and other situations in which coordination is considered necessary. (FMFRP 0-14)

## D

**deep air support**—Air action against enemy targets at such a distance from friendly forces that

detailed integration of each mission with fire and movement of friendly forces is not required. Deep air support missions are flown on either side of the fire support coordination line; the lack of a requirement for close coordination with the fire and movement of friendly forces is the qualifying factor. (FMFRP 0-14) Also called DAS.

**direct air support center**—The principal air control agency of the U.S. Marine air command and control system responsible for the direction and control of air operations directly supporting the ground combat element. It processes and coordinates requests for immediate air support and coordinates air missions requiring integration with ground forces and other supporting arms. It normally collocates with the senior fire support coordination center within the ground combat element and is subordinate to the tactical air command center. Also called DASC. (Proposed modification to Joint Pub 1-02.) (FMFM 5-60)

## E

**electronic warfare**—Any military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. The three major subdivisions within electronic warfare are electronic attack, electronic protection, and electronic warfare support.

a. **electronic attack**—That division of electronic warfare involving the use of electromagnetic or directed energy to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying enemy combat capability. Also called EA. EA includes: 1) actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum, such as jamming and electromagnetic deception, and 2) employment of weapons that use either electromagnetic or directed energy as their primary destructive mechanism (lasers, RF weapons, particle beams).

b. **electronic protection**—That division of electronic warfare involving actions taken to protect personnel, facilities, and equipment

from any effects of friendly or enemy employment of electronic warfare that degrade, neutralize, or destroy friendly combat capability. Also called EP.

**c. electronic warfare support**—That division of electronic warfare involving actions tasked by, or under direct control of, an operational commander to search for, intercept, identify, and locate sources of intentional and unintentional radiated electromagnetic energy for the purpose of immediate threat recognition. Thus, electronic warfare support provides information required for immediate decisions involving electronic warfare operations and other tactical actions such as threat avoidance, targeting, and homing. Also called ES. Electronic warfare support data can be used to produce signals intelligence (SIGINT), both communications intelligence (COMINT) and electronics intelligence (ELINT). (Approved for inclusion in Joint Pub 1-02.)

**emission control**—The selective and controlled use of electromagnetic, acoustic, or other emitters to optimize command and control capabilities while minimizing, for operations security (OPSEC), detection by enemy sensors; to minimize mutual interference among friendly systems; and/or to execute a military deception plan. (Joint Pub 1-02) Also called EMCON.

**essential elements of information**—The critical items of information regarding the enemy and the environment needed by the commander by a particular time to relate with other available information and intelligence in order to assist in reaching a logical decision. (Joint Pub 1-02) Also called EEI.

## F

**fire support coordination center**—A single location in which are centralized communications facilities and personnel incident to the coordination of all forms of fire support. (Joint Pub 1-02) Also called FSCL.

**fire support coordination line**—A line established by the appropriate ground commander to insure coordination of fire not under his control but which may affect current tactical operations. The fire support coordination line is used to coordinate fires of air, ground or sea weapons systems using any type of ammunition against surface targets. The fire support coordination line should follow well defined terrain features. The establishment of the fire support coordination line must be coordinated with the appropriate tactical air commander and other supporting elements. Supporting elements may attack targets forward of the fire support coordination line, without prior coordination with the ground force commander, provided the attack will not produce adverse surface effects on, or to the rear of, the line. Attacks against surface targets behind this line must be coordinated with the appropriate ground force commander. (Joint Pub 1-02) Also called FSCL.

**forward air controller**—An officer (aviator/pilot) member of the tactical air control party who, from a forward ground or airborne position, controls aircraft in close air support of ground troops. (Joint Pub 1-02) Also called FAC.

**forward operating base**—An airfield used to support tactical operations without establishing full support facilities. The base may be used for an extended time period. Support by a main operating base will be required to provide backup support for a forward operating base. (FMFRP 0-14) Also called FOB.

## G

**ground alert**—That status in which aircraft on the ground/deck are fully serviced and armed, with combat crews in readiness to take off within a specified short period of time (usually 15 minutes) after receipt of a mission order. (Joint Pub 1-02) Also known as strip alert.



## H

**high density airspace control zone**—Airspace of defined dimensions, designated by the airspace control authority, in which there is a concentrated employment of numerous and varied weapons/airspace users. (Joint Pub 1-02) Also called **HIDACZ**.

## I

**identification**—The process of determining the friendly or hostile character of an unknown detected contact. (Joint Pub 1-02)

**identification, friend or foe**—A system using electromagnetic transmissions to which equipment carried by friendly forces automatically responds, for example, by emitting pulses, thereby distinguishing themselves from enemy forces. (Joint Pub 1-02) Also called **IFF**.

## J

**joint amphibious operation**—An amphibious operation conducted by significant elements of two or more Services. (Joint Pub 1-02)

**joint amphibious task force**—A temporary grouping of units of two or more Services under a single commander, organized for the purpose of engaging in an amphibious landing for assault on hostile shores. (Joint Pub 1-02)

**joint operation**—An operation carried on by a force which is composed of significant elements of the Army, Navy or the Marine Corps, and the Air Force, or two or more of these Services operating under a single commander authorized to exercise unified command or operational control over joint forces. Note: A Navy/Marine Corps operation is not a joint operation. (FMFRP 0-14)

## L

**low level transit route**—A temporary corridor of defined dimensions which facilitates the low level passage of friendly aircraft through friendly

air defenses and controlled or restricted airspace. (Joint Pub 1-02) Also called **LLTR**.

## M

**main battle area**—That portion of the battlefield in which the decisive battle is fought to defeat the enemy. For any particular command, the main battle area extends rearward from the forward edge of the battle area to the rear boundary of the command's subordinate units. (Joint Pub 1-02)

**maneuver warfare**—A philosophy for action that seeks to collapse the enemy's cohesion and effectiveness through a series of rapid, violent, and unexpected actions which create a turbulent and rapidly deteriorating situation with which he cannot adequately cope. (FMFRP 0-14)

**Marine air command and control system**—A US Marine Corps air command and control system which provides the aviation combat element commander with the means to command, coordinate, and control all air operations within an assigned sector and to coordinate air operations with other Services. It is composed of command and control agencies with communications-electronics equipment that incorporates a capability from manual through semiautomatic control. Also called **MACCS**. (Proposed modification to Joint Pub 1-02.) (FMFM 5-60)

**minimum risk route**—A temporary corridor of defined dimensions recommended for use by high-speed, fixed-wing aircraft that presents the minimum known hazards to low-flying aircraft transiting the combat zone. (Joint Test Pub 3-52) Also called **MRR**.

## N

**naval surface fire support**—Fire provided by Navy surface gun, missile, and electronic warfare systems in support of a unit or units tasked with achieving the commander's objectives. Also called **NSFS**. (Joint Pub 1-02)

**near real time**—Delay caused by automated processing and display between the occurrence of an event and reception of the data at some other location. (Joint Pub 1-02)

## O

**offensive air support**—Those air operations conducted against enemy installations, facilities, and personnel to directly assist the attainment of MAGTF objectives by the destruction of enemy resources or the isolation of his military force. (FMFRP 0-14) Also called OAS.

**offensive antiair warfare**—Those operations conducted against enemy air assets and air defense systems before they can be launched or assume an attacking role. Offensive antiair warfare operations in or near the objective area consist mainly of air attacks to destroy or neutralize hostile aircraft, airfields, radars, air defense systems, and supporting areas. Also called OAAW. (FMFM 5-60)

**operational control**—With respect to a flight, the exercise of authority over initiating, conducting or terminating a flight. (FMFRP 0-14 under “Marine Air Command and Control System”) Transferable command authority which may be exercised by commanders at any echelon at or below the level of combatant command. Operational control is inherent in Combatant Command (command authority) and is the authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission. Operational control includes authoritative direction over all aspects of military operations and joint training necessary to accomplish missions assigned to the command. Operational control should be exercised through the commanders of subordinate organizations; normally this authority is exercised through the Service component commanders. Operational control normally provides full authority to organize commands and forces and to employ those forces as the commander in

operational control considers necessary to accomplish assigned missions. Operational control does not, in and of itself, include authoritative direction for logistics or matters of administration, discipline, internal organization, or unit training. (Joint Pub 1-02) Also called OPCON.

## P

**positive control**—A method of airspace control that relies on positive identification, tracking, and direction of aircraft within an airspace, conducted with electronic means by an agency having the authority and responsibility therein. (Joint Pub 1-02) Also the tactical control of aircraft by a designated control unit, whereby the aircraft receives orders affecting its movements which immediately transfer responsibility for the safe navigation of the aircraft to the unit issuing such orders. (FMFRP 0-14 under “Marine air command and control system”)

**procedural control**—A method of airspace control that relies on a combination of previously agreed and promulgated orders and procedures. (Joint Pub 1-02)

## R

**restricted operations area**—Airspace of defined dimensions, designated by the airspace control authority, in response to specific operational situations/requirements within which the operation of one or more airspace users is restricted. (Joint Pub 1-02) Also called ROA. Also called **restricted operations zone (ROZ)**.

**rules of engagement**—Directives issued by competent military authority which delineate the circumstances and limitations under which United States forces will initiate and/or continue combat engagement with other forces encountered. (Joint Pub 1-02) Also called ROE.

## S

**supporting arms**—Air, sea, and land weapons of all types employed to support ground units. (Joint Pub 1-02)

**supporting arms coordination center**—A single location on board an amphibious command ship in which all communication facilities incident to the coordination of fire support of the artillery, air, and naval gunfire are centralized. This is the naval counterpart to the fire support coordination center utilized by the landing force. (Joint Pub 1-02) Also called SACC.

**suppression of enemy air defenses**—That activity which neutralizes, destroys or temporarily degrades enemy air defenses in a specific area by physical attack, deception, and/or electronic warfare. (approved for inclusion in Joint Pub 1-02) Also called SEAD.

**surface-to-air guided missile**—A surface-launched guided missile for use against air targets. (Approved modification to Joint Pub 1-02.) Also called SAM.

**surface-to-air weapon**—A surface-launched weapon for use against airborne targets. Future developments in air defense systems may lead to the employment of weapons other than missiles. Examples include rockets, directed-energy weapons, and air defense guns. (FMFM 5-40) Also called SAW.

**surveillance**—The systematic observation of aerospace, surface or subsurface areas, places, persons, or things, by visual, aural, electronic, photographic, or other means. (Joint Pub 1-02)

## T

**tactical air command center**—The principal U.S. Marine Corps air command and control agency from which air operations and air defense warning functions are directed. It is the senior agency of the U.S. Marine air command and control system which serves as the operational command post of the aviation combat element commander. It provides the facility from which the aviation combat element commander and his battle-staff plan, supervise, coordinate, and execute all current and future air operations in support of the Marine Air-Ground Task Force. The tactical air command center can provide integration, coordination and direction of joint and combined air

operations. Also called Marine TACC. (Proposed modification to Joint Pub 1-02.) (FMFM 5-60)

**tactical air control center**—The principal air operations installation (land or ship based) from which all aircraft and air warning functions of tactical air operations are controlled. (Joint Pub 1-02) US Navy only; US Air Force changed their TACC to AOC (air operations center).

**tactical air operations center**—The principal air control agency of the U.S. Marine air command and control system responsible for airspace control and management. It provides real time surveillance, direction, positive control and navigational assistance for friendly aircraft. It performs real time direction and control of all anti-air warfare operations, to include manned interceptors and surface-to-air weapons. It is subordinate to the tactical air command center. Also called TAOC. (Proposed modification to Joint Pub 1-02.) (FMFM 5-60)

**target acquisition**—The detection, identification, and location of a target in sufficient detail to permit the effective employment of weapons. (Joint Pub 1-02)

**tasking**—The process of translating the allocation into orders, and passing these orders to the units involved. Each order normally contains sufficient detailed instructions to enable the executing agency to accomplish the mission successfully. (Joint Pub 1-02)

**terminal control area**—A control area or portion thereof normally situated at the confluence of air traffic service routes in the vicinity of one or more major airfields. (Joint Pub 1-02) Also called TCA.

## U

**unmanned aerial vehicle (UAV)**—A powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload. Ballistic or semiballistic vehicles, cruise missiles, and artillery projectiles are not considered UAVs. (Joint Pub 3-55.1)

## Appendix H

# References

### 1. Joint Publications

Joint Pub 1-02	Department of Defense Dictionary of Military and Associated Terms
Joint Pub 3-02	Joint Doctrine for Amphibious Operations
Joint Pub 3-52	Doctrine for Joint Airspace Control in a Combat Zone
Joint Pub 3-55.1	JTTP for Unmanned Aerial Vehicles

### 2. Fleet Marine Force Manuals

FMFM 2	The Marine Air-Ground Task Force
FMFM 2-7	Fire Support in MAGTF Operations
FMFM 3	Command and Control
FMFM 3-21	MAGTF Intelligence Operations
FMFM 3-30	Communications
FMFM 5	Marine Air-Ground Task Force Aviation
FMFM 5-1	Organization and Function of Marine Aviation
FMFM 5-10	Air Reconnaissance
FMFM 5-40	Offensive Air Support
FMFM 5-41	Close Air Support and Close-in Fire Support
FMFM 5-42	Deep Air Support
FMFM 5-45	Suppression of Enemy Air Defenses
FMFM 5-50	Antiair Warfare
FMFM 5-60	Control of Aircraft and Missiles
FMFM 6-18	Techniques and Procedures for Fire Support Coordination
FMFM 7-12	Electronic Warfare

### 3. Fleet Marine Force Reference Publications

FMFRP 0-14	Marine Corps Supplement to the DOD Dictionary of Military and Associated Terms
FMFRP 1-11	Fleet Marine Force Organization
FMFRP 15-5	Electronic Warfare in Combined Arms

### 4. Related Publications

Joint System Threat Assessment Report (STAR), Close Range Unmanned Aerial Vehicle (CR-UAV), dated September 1990

Unmanned Aerial Vehicle Survivability Threat Assessment Reports, Short Range Pioneer RPV System Survivability and Vulnerability, dated 10 February 1988

Marine Corps Tactical Communications Architecture, Midterm, dated 29 June 1992

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